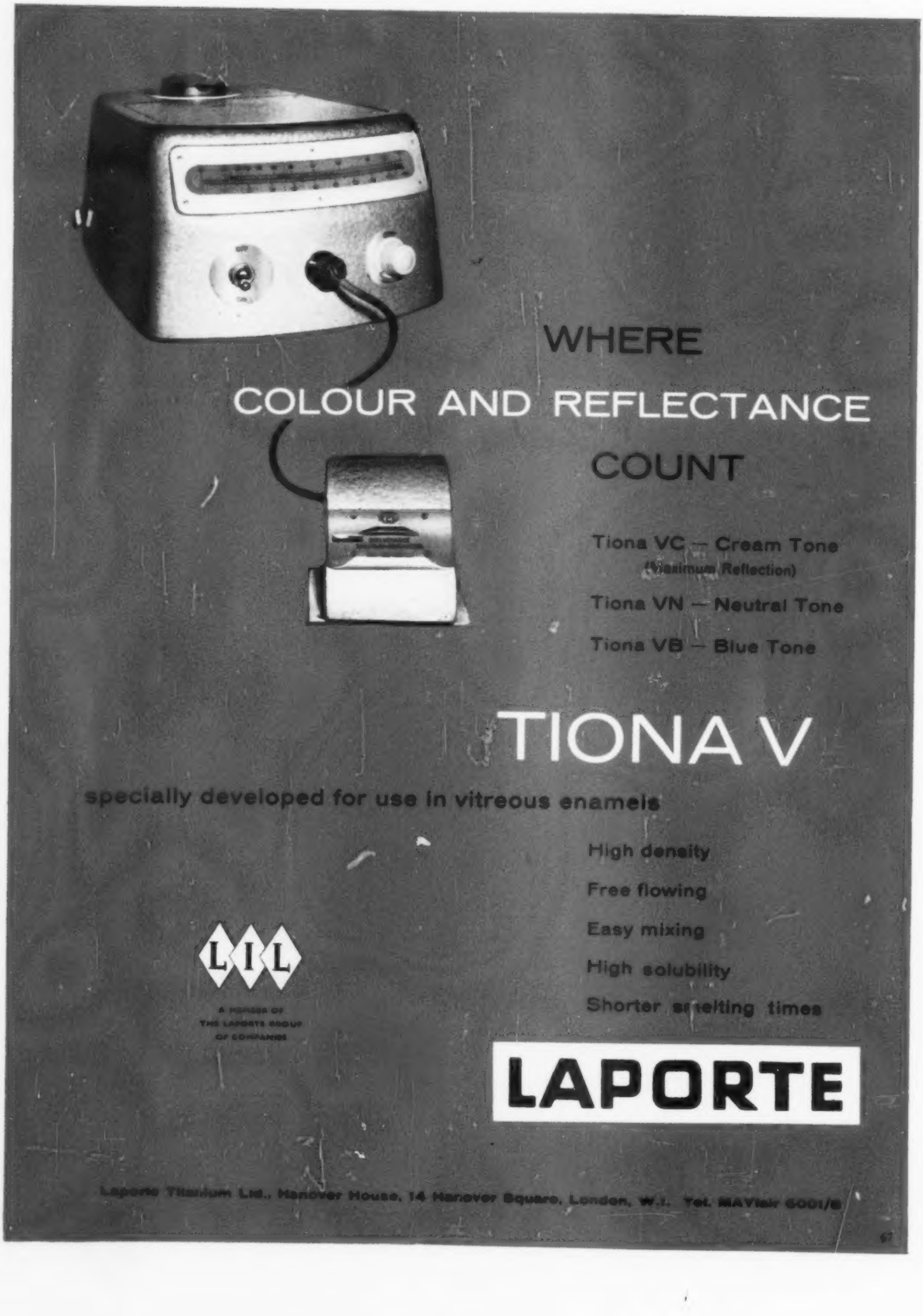
metal finishing

PAINT APPLICATION, ELECTRODEPOSITION, VITREOUS ENAMELLING, GALVANIZING, METAL SPRAYING and all METAL FINISHING PROCESSES.

Vol. 6 No. 61 (*New Series*) JANUARY, 1960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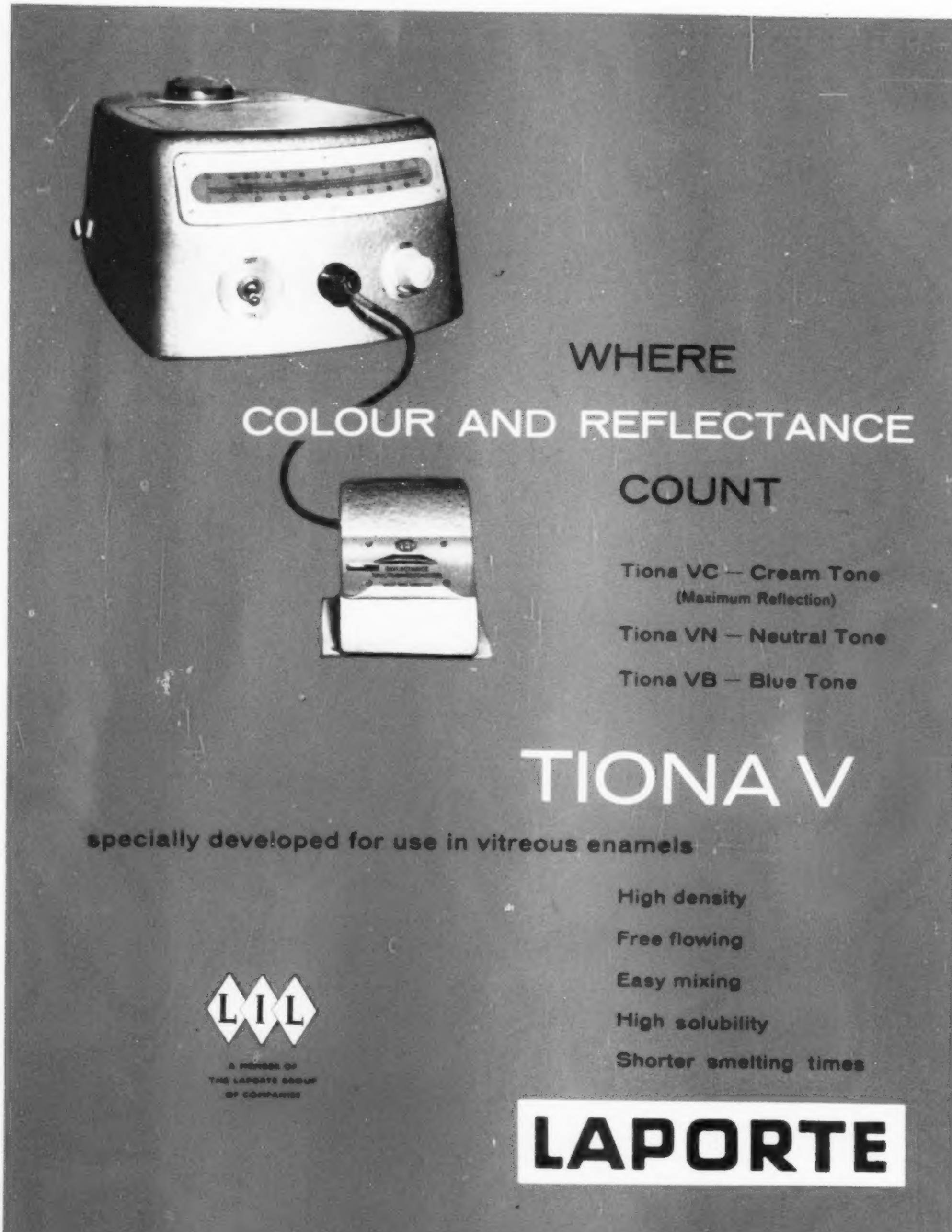
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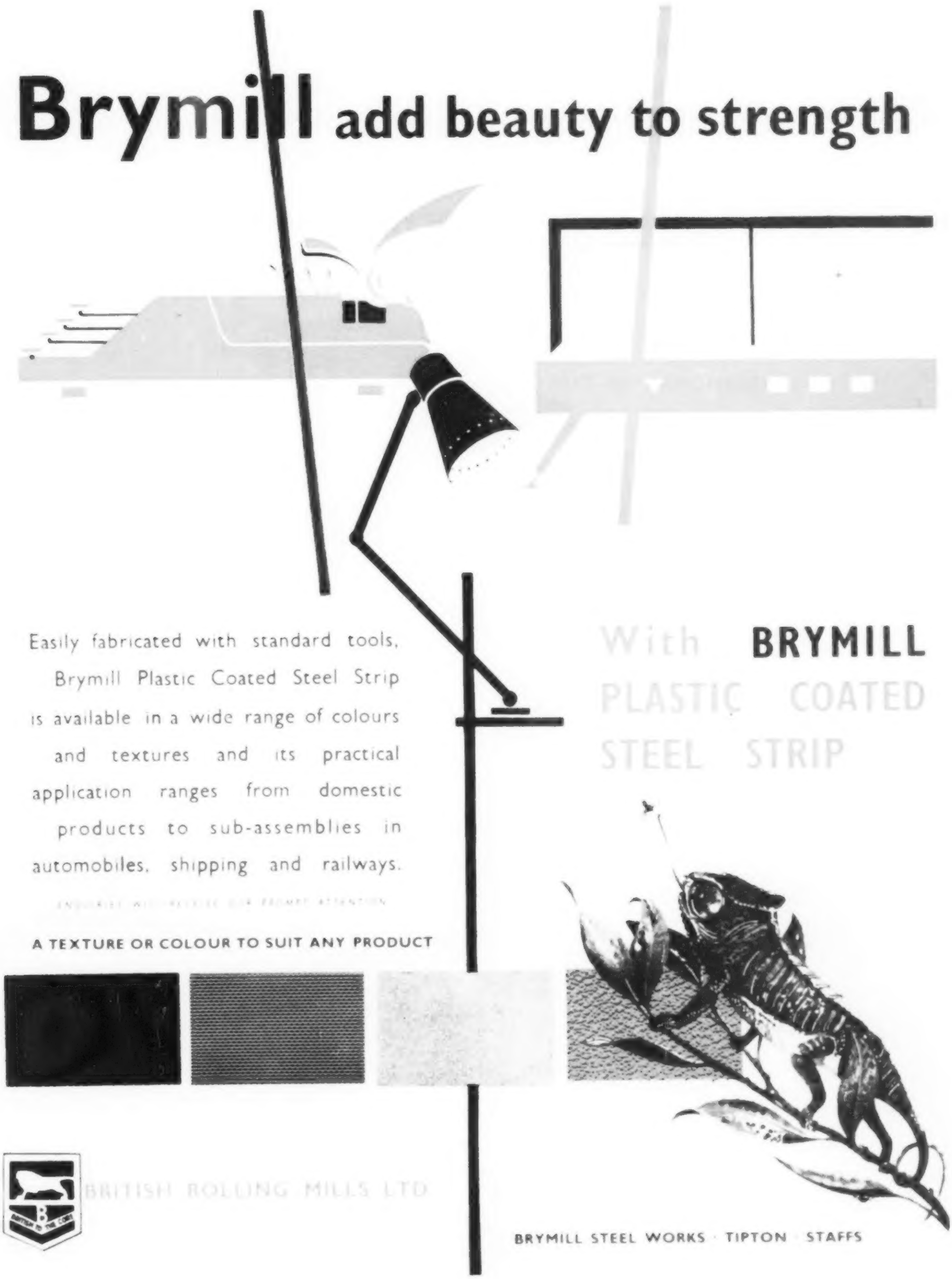
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metal finishing journal

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THIS JOURNAL IS DEVOTED TO THE SCIENCE AND TECHNOLOGY OF PAINT APPLICATION, ELECTRODEPOSITION, VITREOUS ENAMELLING, GALVANIZING, ANODIZING, METAL SPRAYING & ALL METAL FINISHING PROCESSES. THE EDITOR IS PREPARED TO CONSIDER FOR PUBLICATION ANY ARTICLE COMING WITHIN THE PURVIEW OF "METAL FINISHING JOURNAL" AND ALL SUCH ARTICLES ACCEPTED WILL BE PAID FOR AT THE USUAL RATES.

Contents

A HAPPY AND PROSPEROUS NEW YEAR

The Editor, the Area Managers, and the staff of METAL FINISHING JOURNAL extend to all readers, advertisers, contributors and other friends in the industry at home and overseas, sincere and cordial good wishes for their happiness and greater prosperity in the year that lies ahead.

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PURITY AND PREJUDICE

IN the park at Chillingham lives a small herd of wild white cattle, almost the last representatives of their race on Earth and almost certainly doomed to extinction as their rate of reproduction is quite inadequate to maintain their numbers.

The task of those who are earnestly seeking to preserve this fading remnant is made considerably more difficult by a notable characteristic of the species. If any individual member of the herd is handled by man, and such handling must sometimes be necessary in order to render veterinary assistance, the other members of the herd completely reject the individual which has been contaminated by contact with man, often with such violence as to cause its death.

Similar instances of the rejection by a community of such individuals as do not conform to the accepted specification are not uncommonly encountered in the animal kingdom, and they are presumed to be motivated by some fundamental tribal urge to eliminate the unfit and preserve the genetic purity of the race.

So strong is this biological directive that even Man himself has not escaped its influence as is manifested by the many examples of xenophobia which still unhappily persist at many differing levels of civilization. However with the spread of such civilizing influences as education more general recognition is being accorded to the fact that differences in colour of skin, or in location of birth place, or in manner of speech, do not afford grounds for discrimination in a general way against any individual or social group.

We are not, however, concerned directly on this page with the social and industrial problems posed by racial intolerance, but it is an unfortunate fact that similar mental barriers can be, and indeed are being set up between differing groups solely on the grounds of their occupation and training.

There is increasing evidence of a trend to classify human endeavour into groups bearing such general and meaningless definitions as " commerce," " the arts," and " science " (this last perhaps being further sub-divided into " science, pure " and " science, applied "). It has become almost commonplace to speak of the achievements of " science " and to suggest that the " scientists " are responsible for this or that, as though they were a fundamentally different species of being.

Science is after all only knowledge, and the application of it in an ordered way to achieve a given end, and we are all scientists to a greater or lesser extent depending on the amount of study that we have given to our subject. A mother raising her family, the captain of a herring drifter, the mechanic in a garage, and the sales manager in his office, are all steeped wittingly or unwittingly in the science of their calling, no less than is the chemist, the physicist and the biologist.

The social community in which we live requires that each and every member of it shall contribute according to his ability and in seeking his own advancement he serves the common good. The researches of " pure science " are financed by " industry " in the belief, well founded on experience, that the results of most researches are ultimately in one form or another a saleable product. Indeed if such had not proved to be the case there would have been a marked absence of research funds long before now.

Is it then too much to hope that during the decade which starts this year these artificial barriers of thought and outlook will cease to impede the pursuit and application of knowledge for the common purposes of mankind.

Talking Points

by " PLATELAYER "

TOPICAL COMMENT FROM THE MAIN LINES AND SIDE LINES OF METAL FINISHING

SHORTER HOURS ?

ONCE again the engineering unions are pressing for a reduction in working hours, on the grounds that the development of automatic machinery is rendering it necessary for hours to be reduced to maintain employment. Yet one of the features of the post-war era has been that reductions in nominal working hours have not been accompanied by any notable decrease in actual hours worked. The average figure is now something over 48 hours per week, and this, in fact, is largely how the 9 per cent. increase in production has been achieved in the past five years. It has, therefore, been argued that demands for reductions in hours are really only disguised wage claims and that the last things the unions want is a shorter real working week. They only want more overtime hours.

This is probably over-simplification, as there appear to be two factors at work which tend to increase working hours, irrespective of the length of the basic working week. The first is that workers favour overtime, because it is well paid, and employers find it difficult to resist pressure for it. There are many ways in which such pressure can be applied.

The other factor is that no firm likes to reduce staff. Not only is it unpleasant to have to do so in times of recession, but as often as not the trade unions make reductions on the grounds of redundancy very difficult to carry out. Hence, it is regarded by many employers as a safer policy to increase overtime during periods of peak production rather than to take on more employees and have to lay them off later, even if higher overtime rates have to be paid. A further point is that a firm which can offer little or no overtime often finds it difficult to attract workers in competition with firms which do a great deal. The latter, nowadays, seem to be in the majority.

This rather anomalous situation looks like continuing, and can lead to curious situations like that obtaining in the recent recession in the U.S.A. where substantial numbers of workers were unemployed side by side with others working long overtime hours. It does not seem, therefore, that a reduction in the official working week will give the spread of employment that some people hope it will.

BORROW OR BUY ?

MANY firms are becoming increasingly interested in the possibilities of hiring, as opposed to buying, all kinds of goods and services, as a means of conserving capital. Leasing a factory, of course, is an old established operation, but more recently we have become familiar with the hiring of vehicles, scaffolding, accounting machines, and other equipment. One of the attractions is the fact that hire payments become chargeable as trading expenses and are therefore not subject to tax. In this way hiring can often be appreciably cheaper in practice than buying equipment with the limited depreciation allowances now prevailing. Moreover, maintenance agreements can often be made on advantageous terms, and in the case of vehicles, replacements are immediately available in the event of a breakdown.

In this country, capital plant cannot yet be acquired easily for use in industry on a leasing basis, because as often as not it is of a special purpose type not readily suitable for re-sale or re-use in a different location.

In the U.S.A. considerable plant hiring business is being carried out, with mechanical handling plant in the forefront. Whether any supplier would be willing to instal and maintain a plating or painting plant on a hire scheme is a moot point, but it would be surprising if this did not eventually come to pass. The whole thing is largely a question of economics ; given a sufficient degree of reliability and adequate standardisation of design there is no reason why it should not be worthwhile commercially to supply a considerable variety of plant on this basis.

DELAY

IN his presidential address recently the new president of the Institute of Metal Finishing referred to the regrettably long delays to which the publication of original work is now subject. The situation is certainly serious, as delays of up to two years are being encountered in some instances. This is, of course, a reflexion of the vast amount of investigational work now being carried out with which even the enlarged number of post-war technical publications cannot effectively keep pace. Nor would the problem necessarily be solved by creating still more publications as even today much of what is currently printed must go unread for sheer lack of the time necessary for reading.

HOW COLD IS COLD ?

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Progress in Polishing

A one-day Symposium organized by the London Branch of The INSTITUTE OF METAL FINISHING

On November 18 the London Branch of the Institute of Metal Finishing organized a one-day Symposium at the Royal Festival Hall on the theme " Progress in Polishing." This was attended by nearly two hundred members and visitors who took part in the discussion of the four papers presented. The METAL FINISHING JOURNAL report of this meeting which is concluded below includes abstracts of the papers and highlights of the discussion which followed their presentation.

(*Concluded from page* 460, *December*, 1959 *issue*)

ABSTRACT

CHEMICAL AND ELECTROLYTIC POLISHING

*F. H. Wells**

MANY metals can be polished by immersion in chemical solutions, but the principal use of chemical polishing is for aluminium and copper and their alloys. Most of the solutions used are based on phosphoric acid, but a gaseous-phase process has been reported for stainless steel. Chemical polishing reduces the cost of polishing articles of complex shape, and the interior surfaces are polished just as easily as the outside. The process reduces barrel-polishing times if the two processes are combined and in anodizing it can be included as part of the pretreatment cycle, to give a brighter final finish than after mechanical polishing. Analytical control of the polishing baths, which have a long life, is simple.

A wide range of alloys can be chemically polished, but for preference they should be of the single-phase type, and the process has been used for deburring, the preparation of sheet and forgings for inspection and the reduction of foil to thicknesses not attainable by rolling.

Both chemical (and electrolytic) polishing affect fatigue strength only in so far as they remove the Beilby layer when the polishing time is sufficiently prolonged.

Electrolytic polishing is used mainly for stainless and mild steels, and leaded brasses, and to obtain a really specular polish by means of the process necessitates the polishing solution and the material being polished to be suited to each other.

As regards the theory of chemical polishing, this is concerned with film formation and dissolution. All chemical polishing solutions contain nitric acid or other oxidizing agents and it has been suggested that the HNO_3 ennobles the metal surface thus reducing the rate of metal dissolution. The ennoblement may be due to film formation or gas adsorption. There is a great deal of evidence supporting the formation of films, and all investigators agree that nitric acid or the oxides of nitrogen are essential to chemical polishing. Analysis of the gaseous products from the various processes shows that the products from the Erftwerk process were mainly H_2 and O_2 and therefore that the process is different from others. In phosphoric-acid based solutions the dissolution products are more viscous than the bulk of the solution; this viscous layer clings to the metal surface, and eventually controls polishing rate.

Film formation and the viscous layer are also important factors in the understanding of the electrolytic polishing process, and the paper gives the well-known theory of operation of the process and the current-voltage relationship curve. The viscous layer is composed of metal dissolution products which may be complexed.

Of the solutions discussed above those for chemical brightening are the simplest and do not require chemical control because the bath constituents do not break down. The only losses are caused by drag-out.

Chemical polishing solutions have a definite levelling action and the easiest metal to polish by this method is aluminium. The solutions used are phosphoric/nitric/sulphuric acids and phosphoric/nitric/acetic acids. The former solution is rapidly gaining favour at the expense of the latter which steam-distils and throws the solution out of balance. All types of fabricated articles and extrusions are suitable for chemical polishing and in general little or no pretreatment is required.

Cost of chemical polishing is difficult to assess because drag-out will vary from one plant to another.

Solutions for copper alloys are mainly based on phosphoric acid and a suitable one consists of phosphoric/nitric/acetic mixtures. Phosphoric and acetic acids can also be added to nitric-arsenic acid mixtures with improved results.

*Albright and Wilson (Mfg.) Ltd.

Chemical polishing is well suited to mass-production methods and if the articles to be treated do not nest together then they may be treated in baskets.

Electrolytic polishing will treat a wider range of metals and alloys than chemical polishing, but the materials treated commercially are stainless steel, copper and aluminium alloys, nickel, zinc, gold and silver.

Stainless steel was a natural choice for electrolytic polishing because it is a difficult material to polish mechanically although all grades of stainless steel do not respond equally well to the process.

Electrolytic processes for deburring are great cost savers, and the technique can also be used for inspection.

More conventional uses of stainless steel electrolytic polishing are for surgical instruments, tableware, car trim, photographic vessels, etc.

The " Brytal " and " Alzak " processes are used for aluminium, but in general chemical polishing has superseded electrolytic polishing for this material except in a few instances.

The plant required for chemical and electrolytic polishing consists of tanks and services such as electricity and water and equipment to remove fumes. Pretreatment is also necessary to present clean, dry metal to the polishing bath.

DISCUSSION

Mr. H. Neale said that with the rising costs of mechanical polishing, whether automatic or by hand, great interest would be taken in chemically-polished finishes, in the next decade, and not least by the motor industry, with the great volume of material which it used. So far as cost was concerned, there was no doubt that savings could be made by using chemical or electrolytic polishing. It was difficult to give a precise example because there were so many variables, but for a comparable efficiency a combination of mechanical and chemical polishing would give a very much better result and a very worth-while saving in cost.

It would be of interest to learn of the effect on the Talysurf readings which had been given, of a polishing bath in which the aluminium content was much higher than quoted. No doubt the figures given referred to new baths. Had any work been done on materials of much higher Talysurf readings in the first instance? None of those shown appeared to be very bad. It was quite usual for the manufacturer of pressings or spinnings not to take much trouble during the presswork operations to look after his products, so that they arrived at the finishing section severely scratched. That could mean a difficult problem in finishing, whether it was a hand or a chemically polished finish. The manufacturer in such a case could save himself money by looking after the components better.

Mr. Neale drew attention to the possibility of running two chemical polishing baths of a similar nature, one in which the aluminium content (or the copper content) was kept at a low figure, while in the other it was allowed to become considerably higher. In that way consistent results could be obtained at a lower cost than by running a single bath where there was deterioration of the degree of polish obtained, due to the dissolved alumniium. The most important feature to the buyer was consistency of results.

Chemical polishing should have a considerable future in automatic plants, and there could be no doubt that as aluminium became more and more widely used that would be found to be the case. Was the author in a position to confirm that his automatic plant was completely satisfactory with chemical polishing solutions of the type he had mentioned? Were there any drawbacks which might be difficult to overcome?

Mr. F. H. Wells replied that the Talysurf tracings for aluminium given in the paper referred to a bath of average composition, by which he meant that it had an aluminium content of roughly 30 gm. per l. He could not reply to the second question, about new baths ; in all the tests an attempt had been made to use baths of an average type of composition, to avoid an unrealistic type of result. The two-bath system was suitable for the user who had a mixture of grades of work, the newer bath being used for high-quality work and the other for work which was not so important. With the one-bath system equilibrium was reached between dragout and aluminium content and the bath usually stabilized itself at an aluminium content of 25-35 gm. per l. Baths were in operation which had been working continuously for up to two years simply because dragout and the build-up of aluminium content had been balanced.

The use of automatic plant presented no difficulty ; he had seen such plants in France and the U.S.A. and the type of solution in question could be used with the ordinary types of automatic plant obtained from the supply houses.

Dr. H. E. Zentler-Gordon said that he was disappointed to find such a high proportion of the paper devoted to chemical polishing and so little to electrolytic polishing.

It was important in a paper such as this to quote the comparative costs of the processes described. It was not clear whether the one example of costs given by the author referred to chemical or to electrolytic polishing. Presumably it referred to chemical polishing of aluminium. In that case it might lead to the erroneous conclusion that chemical polishing or brightening was in all cases more economical than the electrolytic method. A second

omission, which Dr. Zentler-Gordon regarded as important, was the fact that it was possible today to polish electrolytically a great variety of copper alloys in a process which did not bear any comparison with the well-known fuming mixture of acids which had been employed for at least twelve years and was known as chemical polishing.

Chemical polishing looked very much like bright dipping, and required a fuming mixture of strong acids evolving nitrous fumes, operated at nearly the temperature of boiling water and with a fume exhaust. For certain aluminium articles this was an excellent method of polishing, especially for small articles which could be put in baskets and did not have to be wired or jigged up, but it should be said that today it was possible to electropolish copper alloys, and especially brass, and it was being done on a much larger scale than chemical polishing, using a solution operated at room temperature with no nitrous fumes, employing simply phosphoric acid and organic additions such as alcohol. Such plants were operating in Western Europe and about a dozen were now in commercial operation in this country, although the manufacture of the plant in this country had started only twelve months ago. The cost of the process and of the chemical control of the process was lower in comparison with that of chemical polishing, because the solution was non-consumable and did not vary with time. The metal removed at the anode was taken out at the cathode and the only loss was dragout. The viscosity was much less than that of chemical polishing solutions and it was obvious that the cost would be low. The initial capital expenditure was in every way comparable to that for the stainless-steel installation with fume extraction required for chemical polishing.

Chemical polishing involved a mixture of strong acids evolving fumes and requiring fume extraction, operated at 100°C., with an effluent problem in disposing of the concentrated acids and with very little control from a process and automatic plant point of view, because the process was fast, taking 1-3 minutes ; whereas the electrolytic process, where the only loss was dragout, had a cycle of 6-10 minutes, which was much more amenable to automatic plant operation and there was no effluent problem and no fume extraction.

It would appear from the paper that any copper or aluminium alloy was suitable for chemical brightening, but that was not so. Today it was necessary to prepare special fine-grain-size material for the electrolytic and chemical polishing of copper alloys. The average grain-size should be between 0.15 and 0.25 mm. These two points were important. The cost comparison should also be made on a quantitative basis. Potential users would wish to know how much it would cost to process a square foot of metal, however intricate in shape. He was prepared to say that the cost should be as little as 2d. per sq. ft. in chemicals and electricity to electropolish brass of suitable quality with reasonably small grain-size and not too many rolling defects or surface inclusions.

With aluminium there was a definite case for chemical brightening and polishing, because the conditions with regard to surface area treated per gallon of solution were favourable. but that was not so with copper alloys. For stainless steel there were very few data and time did not permit him to go into the matter. The author had quoted the patents and the papers, but many of the really important names in electropolishing had not been mentioned, such names as Professor R. A. Jacquet and R. Mondon of France, Dr. C. L. Faust, of the U.S.A., and Dr. G. Pray, and also Dr. Edwards, of the B.N.F.M.R.A. During the last fifteen years valuable quantitative data on the comparative costs of electrolytic and chemical polishing had been published together with detailed theoretical explanations ; and the theoretical explanations given in the present paper were summaries of the well-known theories. With regard to the diagrams showing Talysurf readings, the facts shown by them for stainless steel had been known and used for at least thirteen years and had been published by the Institute of Metals in 1948 and 1951.

Mr. Wells said that the fact that seven times as much space in his paper had been devoted to chemical as against electrolytic polishing might be explained and justified by the fact that that was the order of their relative interest to industrial users. So far as both chemical polishing and electrolytic polishing were concerned the paper was based on the experience of Mr. Wells' firm. It had been found that the chemical polishing of aluminium was to a large extent replacing the electrolytic polishing of aluminium simply because the former process was easy to control, produced good results with less trouble and enabled lower grades of labour to be used.

Mr. Wells could not agree with Dr. Zentler-Gordon that the chemical polishing of brass was only equivalent to bright dipping. Mr. Wells felt that his own view could be proved beyond doubt by the Talysurf diagrams in his paper. The first trace showed a brass before treatment with an ordinary rolling-mill finish of 47 micro-in. After two minutes chemical polishing the second trace showed that it had a roughness (or smoothness) of 28 micro-in. The third trace showed the same piece of brass after treatment for 10 minutes, with a surface finish of 10 micro-in. After 15 minutes the figure was 9 micro-in. The last two traces in Fig. 9 were for bright dipping. The original finish which was 43 micro-in., after a bright dip for 10 sec. became 38 micro-in. If left in for 15 sec., however, the roughness tended to

increase again, and to an extent far greater than that found on the original surface of the brass.

So far as costs were concerned, and still talking about brass, the initial cost of the electrolytic polishing of brass would often be very much greater, and the polishing time, instead of being 1-3 min., could be 15-20 min., usually with current densities of 150-200 amp. per sq. ft. Copper would plate out on the cathode and the life of the solution might be greater to some extent, but it might be necessary to choose between initial costs and running costs. If a company wanted low initial costs, chemical polishing was the answer; for low running costs electrolytic polishing was to be preferred, but Mr. Well's firm had found that chemical polishing could be achieved at Dr. Zentler-Gordon's figure of 2d. per sq. ft. without much trouble.

Fine-grain brasses responded well to chemical polishing, but their use was not essential. A grain-size of 0.4 mm. was usual. This was a process where everything had to be related to suitability. It was necessary to reach a compromise between deep-drawing properties and polishing properties and it was for the user to choose what he wanted. But fine-grain brasses were not necessary ; they gave an improvement over coarse-grain brasses, but the object could be achieved by what was now known as a fine-grain brass or an ordinary run-of-mill brass.

With regard to stainless steel, everything stated in the paper was the result of his own experience and there was nothing second-hand about it.

Dr. Zentler-Gordon said that he had never said that chemical polishing was akin to or gave the same results as bright dipping. His point was that in the operation of the process—not in the result—chemical polishing was very akin to bright dipping. Both used boiling solutions operated with fume extraction ; neither could be controlled very easily, because it was not possible to see what was happening. By no stretch of the imagination could they be compared with an electrolytic process operated at room temperature with no fume extraction and no solution change except by dragout.

So far as fine-grain-size for brass was concerned, it was entirely a matter of the standard of finish. Brass with average grain-size could not give anything like such results as were obtained with a grain-size of 0.15-0.25 mm. That was true in any industry where smooth, reflective surfaces were necessary. Metallurgically the standard of finish must depend on the grain-size.

On the question of prime costs and running costs, it seemed unlikely that anyone in the industry, apart from the smallest shop, would be short-sighted enough to install a process which, though cheaper in initial cost, cost much more to run, so that the benefit in prime cost was wiped out in three months. The initial cost of the electrolytic process might be slightly higher, but the running costs were lower. Where the standard of quality was not all-important and the work could be batched and handled in baskets of several dozen, the position might be different.

Mr. A. W. Brace said that he wished to comment on the problems of the aluminium supplier. It was the desire of everyone continually to produce higher quality at a lower cost. The tendency was for the aluminium producer to have to resort to production techniques which involved handling the sheet on mills which used ever higher speeds, and that gave rise to greater problems in maintaining the high-quality surface finish, so that the customer could buy strip, form it to the finished shape and then hand it to the metal finisher, who would merely be expected to produce a mirror-like finish.

This involved some problems, because it was not easy to meet all the requirements. First of all, the aluminium producer had difficulty in maintaining the high standard that was wanted if customers were expecting merely to brighten chemically and then anodize and get a mirror-like finish. He suggested that two trends were developing. One was that to some extent chemical brightening or polishing was providing a means of producing a fairly uniform and not unattractive bright finish on aluminium, which was acceptable for a number of applications ; but, if a really good finish was wanted, a combination of some mechanical polishing followed by a brightening polishing was still needed.

His own experience led him to make the comment that electrolytic brightening seemed in those circumstances to give a somewhat higher standard of finish, and he thought that the alkaline brightening process, which had been sold under the trade name of Brytal, was one which ought not to be lightly disregarded. It had served for a long time and he thought would continue to do so for some time to come. There were also other processes which were worthy of consideration.

At one point in the paper the author suggested that no chemical control was necessary, but later he referred to control of nitric-acid content. In the experience of Mr. Brace's organization the nitric-acid content of these chemical brightening baths was somewhat critical if it was desired to maintain a consistent standard. If it was desired to achieve a mirror-bright or near-mirror-bright finish the nitric-acid content had to be kept within fairly narrow limits. Perhaps the author would comment on the reason for the fact that high nitric acid contents gave virtually as bad results as the absence of, or very low nitric acid contents.

In the plants which he had recently visited in

the U.S.A. he had found that so far as automobiles were concerned the general practice was so far as possible to polish the components on automatic equipment and then give a chemical brightening treatment in a bath. That seemed to be a combination which could be set against electrolytic brightening as a way of achieving the highest standard of finish at a reasonable standard of cost. The phosphoric-sulphuric-nitric chemical brightening process laid more problems at the door of the metal producer than processes in which some mechanical polishing could be done, even to a lower standard than normal, followed by a brightening process which was less vigorous in its action than the usual phosphoric-sulphuric-nitric process.

MR. WELLS, in reply, said that in his experience the surface quality of aluminium had improved greatly during the last three or four years and this had made the task of the chemical polisher very much easier. It had been his experience that, for aluminium, electropolishing was being replaced by chemical polishing in many cases, particularly when the electrolyte used for electrolytic polishing had been of the phosphoric-acid alcohol type. So far as analytical control was concerned, he might have been misunderstood. In operating a chemical polishing bath the nitric-acid content should be checked once or twice daily and nitric acid added to the bath as might be necessary, making up for dragout losses by adding a fresh mixture. He was convinced that that was the best procedure. There was, however, another type of user who would get his experience by trial and error and who after a few days or weeks knew from the appearance of the work coming from the bath what to do to correct anything that had gone wrong. Some people worked in that way and obtained good results.

The next question concerned the effect of high nitric-acid content. He did not know the reason for the type of result which was obtained by using an excessively high nitric-acid content, but the fact was that it gave a reticulated pattern over the surface of the aluminium. Should the analytical control or operating experience be adequate, that did not happen. It had been found that the best way to control the chemical polishing bath was to adjust its density by adding water.

With a chemical polishing bath for aluminium, after two or three weeks the dragout came to a state of equilibrium with the aluminium build-up. When there was a concentration of 25-35 gm. per l. of aluminium (and this happened quickly in a bath operated continuously, probably in a fortnight to three weeks) the best nitric-acid concentration to use was between 5 and 6 per cent. That had been proved both by laboratory experiment and by operating experience.

When a bath reached that condition the density had to be maintained at 1.78 or less, the nitric acid concentration at 5-6 per cent and the aluminium content between 25 and 35 gm. per l. (Fig. 1). Under those conditions the bath would operate and would maintain the equilibrium conditions for a very long time. Baths had been operating for 12 months and in one instance for 3 years.

MR. S. C. BOYLE observed that there were theoretical grounds for supposing that it might be possible in the future to polish stainless steel chemically. Had the author any experience of this and any comments to make?

MR. WELLS replied that partial success had been obtained in chemically polishing stainless steel in the laboratory, but he would emphasize that it had been done in the laboratory; he did not think at the present time that it would be possible to polish stainless steel chemically on an industrial scale. Experiments had been based on the simple theory of chemical polishing, namely that it was caused by the rate of film formation, the rate of film dissolution, and the rate of passivation and the rate of depassivation. If, therefore, a phosphoric-acid nitric-acid mixture was used, which would passivate stainless steel, and a halogen agent added which would depassivate it, it should be possible to produce chemical polishing. But a stainless steel which had been severely stressed would chemically polish in one part and etch in the other.

There had been one or two German processes which claimed to polish stainless steel chemically. But they did not produce what in this country would be called "polishing."

MR. V. SMITH said he was using both the chemical polishing processes referred to in the paper and on the chemical polishing of copper alloys he dealt with 10,000 pieces a week. In case Dr. Zentler-Gordon had spread alarm and despondency it should be added that there was no effluent problem at all which anyone who dealt with ordinary strong acids had not already experienced. There was no necessity for any mass dumping of a solution which seemed to have a more or less indefinite life. Moreover, for the chemical polishing of brass and copper alloys the temperature was not boiling-point but 140°F. It was, Mr. Smith agreed, a question of economics, but he supported the author by saying that certainly brass could be chemically polished for less than 2d. per sq. ft.

His plant had been installed to deal with a motor-car component. It had been said that morning that if only the motor manufacturers would give advance notice of what they intended to do it would make life much easier. His plant had been expensive to install and was intended for a brass grille which was chromium plated. His company had decided to do chemical polishing

instead of electrolytic, and were glad that they had done so, because the motor manufacturer had decided to have an aluminium grille instead of a brass one, and all that they had been necessary was to take out the solution for brass and put in the chemical polishing solution for aluminium. If an electrolytic plant had been installed it could not have been used for the aluminium grille.

Mr. R. Whitlock invited the author to enlarge on the relationship between the degree of polishing and the total amount of metal removed, which could be of importance in dealing with thin or accurately-formed objects.

Mr. Wells said that if the question referred to aluminium he would say that in a 3-min. polishing period in a sulphuric-type mixture 0.0008 to 0.0012 in. were removed. A highly alloyed material such as Duralumin would react much more rapidly. It was difficult to relate time to metal removal, because it was affected by so many factors, such as the aluminium content of the bath. The figures which he had just quoted related to a bath of 25-30 gm. per l. aluminium content. The first 10-15 sec. of the immersion time was probably usually a cleaning process, and after that chemical polishing set in.

Mr. Whitlock explained that he was concerned with the possibility of polishing foils and similar materials and getting a good polish before etching right through them. The thickness of the foil would be 0.001-0.002 in., and the material was copper.

Mr. Wells replied that the solution rate for copper in the solution of which he had experience was a little less than that for aluminium, so that it would be less than 0.001 in. for 3 minutes and would probably be 0.0002 in. per min. at 60-65°F. There was another feature which might be a nuisance. Because of the levelling action of the solution, any sharp edges tended to be rounded off, and there would be greater attack on the edges of the foil than on the centre.

Mr. Curtis referred to the mention in the paper of the use of oxidizing agents in the chemical polishing solution and to the brief reference to hydrogen peroxide and asked whether any exhaustive work had been done on hydrogen peroxide as an ingredient or had it been turned down finally as not giving the results required. From the point of view of future interest, having regard to the new methods of making this material and the reduction in price, was there any possibility of using hydrogen peroxide in chemical or electrolytic polishing?

Mr. Wells regretted that the answer to that question, so far as his own experience was concerned, could not be very encouraging. Hydrogen peroxide had been used with cyanide solutions for the chemical polishing of silver, but the application had not been widespread. It had also been used in place of nitric acid in conjunction with phosphoric acid for polishing aluminium, but the results had been inferior and its use had been abandoned. Generally speaking, he thought that nitric acid had become the most important oxidizing agent used with these solutions, and one or two long-term experiments which had been made to find a substitute for nitric acid had not been successful. There was the Marshall solution for mild steel, but it was tricky to operate and the solutions became rapidly exhausted and were not more than a laboratory curiosity at the moment.

Mr. A. A. Pearson in a written contribution commented as follows:

The high cost of chromium plating, coupled with its frequent poor performance in service, has prompted a search for alternative finishes costing less and having improved corrosion resistance. The use of stainless steel and aluminium for decorative trim on motor cars has increased, these being accepted as the best alternatives to chromium plating. However, the cost of mechanically polishing these materials is high and the search continues for improved and cheaper methods of polishing. Chemical and electrolytical treatments have been tried out extensively, but for various reasons without complete success. After reading Mr. Wells' paper one is likely to form an opinion that aluminium car parts can only be brightened successfully by immersion in solutions containing phosphoric acid, and that mechanical polishing of a lot of metals is "on the way out."

This is completely untrue, as there is no doubt that any parts having an expanse of flat area cannot be polished to a good standard by chemical or electrolytic means. Moreover, the elimination of press marks, surface scratches etc., if not impossible, is most difficult and uneconomical by this treatment. A more serious criticism is the poor reputation likely to be given to the finish with these blemishes still present, together with a certain amount of "bloom" which seems to be associated with chemical or electrolytic polishing. Sometimes one can only describe the result as "caravan finish."

Aluminium

For a number of years German car manufacturers have used brightened and anodised "aluminium" in place of chromium plated brass or steel for certain items of decorative trim. Until fairly recently the "aluminium" used was almost exclusively an aluminium-magnesium alloy based on super-purity aluminium. Originally the main process for brightening was the Erftwerk treatment, sometimes, but not always, following a brief mechanical polish. After anodising and proper sealing, the result was, and still is, an excellent alternative to conventional chromium plating, with improved corrosion resistance.

With this German experience in mind, it is somewhat surprising to see the very poor finish on certain aluminium trim parts on new cars. The reasons for this low standard are in the main ;

(a) The high cost in this country of the alloy sheet and strip known in Germany as " Reflectal."

(b) Following (a) the use of lower grade materials which do not brighten to the same degree as does " Reflectal " by any process, chemical or electrolytic, and

(c) The over emphasis placed on the necessity to provide a thick anodic coating for wear resistance. For any given alloy, the brightness obtained by chemical or electrolytic treatment is progressively reduced with increased anodic film build-up.

It would seem that the maximum saving to be gained from using aluminium for car trim is being extracted at some disadvantage to the finish. Whilst substantial improvements have been made to the lower grade alloys by the aluminium manufacturers to enable them to be chemically and electrolytically brightened to a higher standard than was possible say two years ago, there is no doubt that very often this treatment should be complementary, and not alternative to mechanical polishing.

Deciding what aluminium alloy to use and which brightening process to follow are problems which face the motor car manufacturer desirous of obtaining the best finish possible at moderate cost. This rules out the super-purity aluminium based material which is always given an overall cost in excess of his datum, that is to say the cost of the same items in brass or steel chromium plated.

In respect of processes, one would assume from Mr. Wells' paper that the only process for brightening aluminium worthy of attention is chemical treatment in baths of phosphoric/nitric/sulphuric and phosphoric/nitric/acetic acid compositions.

Admittedly the German Erftwerk process is not suitable for other than the super-purity based aluminium-magnesium alloy. The Germans themselves realise this, and in line with developments in that country with lower grade alloys there would now seem to be a change-over to the electrolytic Aluflex process.

This bath has greater versatility in respect of the grade of aluminium alloy which can be brightened and also has a greater possibility of being conveyorised than has the Erftwerk process.

The short space which Mr. Wells devotes to electrolytic polishing makes no mention of the Aluflex process at all, which it is suggested is the only serious rival to the chemical treatment solutions based on phosphoric acid. It was hoped that Mr. Wells would present the " pros and cons " of both chemical and electrolytic polishing treatment. This would help anyone in the position of the writer to decide which treatment to instal for large scale processing. Mr. Wells has made out a very good case for chemical polishing. In the subsequent discussion Dr. Zentler-Gordon spoke with some feeling on the electrolytic polishing of brass parts. We heard little, if anything, at all, of the electrolytic polishing of aluminium.

On page 8 of his paper Mr. Wells gives the area of work surface that can be polished per gallon of phosphoric acid based solution, which is understood to cost approximately £1. The average cost per square foot would therefore be about 2½d. The Aluflex Pilot Plant which has been in operation in the writers works for two years gives an average cost of 3d. per square foot. There is reason to believe that with a production sized plant the cost would be substantially reduced.

With this small scale electrolytic polishing experience in mind it is disappointing to have to erase cost of processing from the list of advantages of chemical brightening in a solution based on phosphoric acid when contemplating such an installation.

It is claimed that phosphoric acid based solution can be used in an automatic plant. Having seen such a plant at the Simca Co., near Paris to which Mr. Wells refers I would point out that in May this year a substantial part of each radiator grille seen chemically brightened was subsequently mechanically polished, the finish otherwise being unacceptable. It would seem therefore, that no automatic plant for brightening and anodising aluminium so far is really successful.

Undoubtedly there are many points in favour of chemically brightening but Mr. Wells does not describe these completely, and by not making full reference to electrolytic polishing of aluminium one is still left in doubt which process is to be preferred for the treating of the many thousands of parts which are manufactured under the classification of " decorative car trim " to a standard which will not be described as " caravan finish."

Stainless Steel

The stainless steel used extensively by the car manufacturer for decorative purposes is more correctly termed Ferritic Chromium Iron. This material is more difficult to polish electrolytically than the 18/8 type usually understood by the term Stainless Steel.

The writer's company has manufactured trim parts in chromium iron in large numbers over 10 years. During this period many attempts have been made to find a process for " wet " polishing which will reduce the high cost for finishing by mechanical polishing, even with automatic equipment. Apart from the smallest items of strip trim having no large flat areas to reveal tool marks and imperfections no process for electrolytic

polishing has been found entirely satisfactory. The most promising is the much maligned perchloric acid-acetic anhydride bath which caused a disturbance in Los Angeles some years ago.

Mr. Wells makes no mention of this process which is now extensively used on the Continent for electro-polishing domestic ware, surgical instruments etc., apart from deburring office machinery parts and gear wheels, to which application Mr. Wells refers in his short list of uses for electrolytic polishing. The perchloric acid-acetic anhydride bath with simple precautions is entirely safe to operate. It would appear to be influenced less by the factors of grain size, cleanliness and composition of the material to be polished, which often cause other processes especially those containing phosphoric acid to give inconsistent results.

Mr. Wells replies :

I agree with Mr. Pearson's remarks that the use of chemically and electrolytically polished aluminium for car trim is expanding, but cannot accept that I implied mechanical polishing is " on its way out." In page one of my paper I mentioned that each process had its own particular field of application and that to obtain the best result it was sometimes worthwhile to combine mechanical and chemical polishing. I did not state that aluminium car trim can be polished only in those solutions based on phosphoric acid but it is a fact that the greater proportion of car trim produced in this country is treated in this way.

The reason for devoting most of my paper to phosphoric acid solutions and electrolytes is that they are in general use and, because my experience has been with this type of solution, I feel qualified to talk about them.

I am not familiar with the bloom that Mr. Pearson associates with chemical and electrolytic polishing, but every process is capable of being incorrectly operated. The objection of blooming could also be applied to badly mechanically polished metals and to bright nickel deposits.

Mr. Pearson suggests that when compared with " Reflectal " the lower grades of aluminium do not brighten so well ; this is only partly true as will be seen by referring to the table of reflectivities given on page seven of my paper. Commercial aluminium (99.00 per cent) responds exceptionally well to chemical polishing in phosphoric acid-based solutions ; loss of image clarity occurs during anodizing. Aluminium having a purity of 99.5 per cent can be chemically polished and anodized to give a good result. The type of material now favoured for car trim (99.7-99.8 per cent Al + 0.5-1.25 per cent Mg) is a very good compromise. We do agree that some manufacturers are insisting on an unnecessarily thick anodic coating that detracts from the finish obtained on lower purity metals. Thinner anodic coatings properly sealed have been proved to be satisfactory.

The proportion of space in my paper allotted to chemical and electrolytic polishing is indicative of the relative industrial importance of these processes. A very good case for chemical polishing was put forward simply because this case existed. We have developed our own electrolytic process for treating aluminium but we have had little necessity to refer to it.

I have refrained from mentioning trade names in the paper, but cannot accept Mr. Pearson's remarks about the relative costs of chemical polishing using phosphoric acid-based solutions and the Aluflex electrolytic polishing process. He mentions costs of 2½d./sq. ft. for chemical polishing and 3d./sq. ft. for the Aluflex process. As far as we are aware, these figures do not have a common basis for comparison. Before it is possible to make such a comparison it would be necessary to treat the same grade of metal by both processes. It would also be necessary to make tests on aluminium having the same surface finish and to continue treatment to obtain the same total reflectivity and specular reflectivity after treatment. We consider 0.5-2.0d. covers the usual range of costs for polishing 1 sq. ft. of aluminium. This refers to chemical costs. Chemical polishing treatment times are usually much shorter than those used during electrolytic polishing.

Plant costs are also much lower for chemical polishing processes and, of course, there is no need to apply any electrolytic processing. We would like to emphasize that the low cost of processing is one of the main advantages of chemical polishing and that the process is capable of being operated in an automatic plant.

Whilst agreeing that perchloric acid electrolytes can produce very good results on chromium iron, I would not like to recommend their use without a very thorough investigation into their explosive behaviour. This we have not done.

ABSTRACT

RECENT DEVELOPMENTS IN THE FIELD OF BARREL FINISHING

*C. J. Kellard**

BARREL polishing prior to plating is a scouring process, the barrels being octagonal in shape and the media ranging from granite to synthetics derived from aluminium oxide. To finish the average component usually requires three basis operations, *viz.:* scouring using an abrasive, smoothing with a non-abrasive compound (this can be done in the same barrel), and polishing using steel balls etc. as the polishing medium. Although these sequences may appear somewhat costly, it should be realized that one load may

be as much as 100,000 components and the labour costs are very low, thus the final cost per piece is infinitesimal. The main disadvantage is that quality control is difficult. Also the process, being a wet one, increases the risk of surface corrosion and staining.

In the submerged system of barrelling, an octagonal barrel, which is perforated with a series of holes along each flat is suspended in a lined tank filled with chemical compound, the complete barrel assembly being designed so that it can be raised and lowered into the tank to facilitate loading and unloading. The barrels are made of rubber or neoprene reinforced by a perforated steel backing plate. For the polishing medium a new type of chip has been developed having a large crystal structure with greater density to compensate for the mass weight loss due to immersion. This medium has proved very successful in giving a regular cutting action, producing an exceptionally fine surface of good colour ; it is also easily converted into a burnishing medium by using a burnishing compound of pure sodium oleate and calcium sulphate. As in normal barrelling, parts should not exceed 5 oz. in weight and 6 in. in length unless a fixture technique is used.

Since the solution is contained in a tank and is used continuously, the problem of effluent disposal is not the same as in normal equipment, *i.e.*, the unit is self-contained and does not require special drainage. The equipment is provided with take-off points so that the spent solution can be piped away (usually once per week). For different operations the barrel is simply moved from one tank to another as required. The elimination of handling of the components from one barrel to another is an advantage and the control to produce a given result is less critical than with closed barrels. Where a large volume production is required the standard equipment can be made automatic, the set-up being " in-line " or "looped."

As distinct from the closed barrel system the solution in the submerged system is used for 20 to 30 cycles before requiring renewal, the savings in consumables therefore being of the order of 90 per cent.

It has been shown that with the submerged process stainless steel and nickel alloys can be finished to a very high standard. In addition to preparing metals and alloys for electroplating, this barrelling technique, which produces a surface finish of 10 to 2μ-in., can be used in grinding and honing operations and eliminates the third grinding pass with a consequent reduction in cost.

The paper gives typical examples of cost savings, *e.g.* on a stainless steel bracket barrelled by the two methods the cost per piece being 0.457d. and 0.173d. respectively.

The preshaped barrelling chips previously mentioned (developed by the author's company) can be used for submerged or closed barrelling. Two basic types are available in a range of seven sizes. Another media development has been the production of various steel shapes to eliminate "shadowing" experienced in burnishing where only steel balls were used. For those components of awkward geometry or weight, etc. which cannot be treated normally the spindle machine and the Vibrasheen processes have been developed. The former consists of a number of spindles, to which the components are attached, which are then lowered individually into a trough containing media with a suitable compound, the trough being turned at a peripheral speed of 300 to 600 ft. per min.

The Vibrasheen process consists of a frame into which a tub is fitted being located on coil springs with longitudinal stabilizers. Media, compound, water and components are loaded into the tub which is then vibrated at the required frequency and amplitude to give a scouring and finishing action on the surface of the components. The main advantage of the process is for parts having bores and deep recesses ; however, these must be greater than 3/16-in. dia. and less than ½ in. deep. Chip sizes are the same as for conventional barrel finishing. Sintered metallic chips have also shown good results.

Further test development is being undertaken using ultrasonics in parallel with mechanical vibrating action.

Discussion

Mr. E. A. Ollard said that it might be pertinent to define what was meant by polish. Mr. Wells had mentioned the S/T ratio, which compared the light specularly reflected to the total reflected, and the more the light specularly reflected the better the polish. One factor which Dr. Gill seemed to have completely neglected, however, was the area of the reflecting surface. A ball bearing could be very highly polished and if the S/T ratio was measured at a small point there the ratio would probably be well over 90 per cent, and perhaps 98%; but a very large number of ball bearings under the same conditions would appear to have a matt surface and the S/T ratio would be quite small. A great deal depended, therefore, on the area concerned.

That was extremely important in practice because if something had a high S/T ratio over a big area it would give a specular reflection of its surroundings. With reflection from a large area there would be reflection of the surroundings, which gave a certain amount of movement and interest and attracted the eye. With the processes, under discussion a fairly high S/T ratio might be obtained at a point, and that would mean that the

article, whatever it was, would look bright and shiny, but it was very unlikely that there would be any sort of specular reflection over a large area, which meant that there would not be the effect of seeing the surroundings in the article.

If when polishing something like an entree dish mere brightness as given by barrel polishing or electrolytic polishing was not enough. If polishing something which had not a large area and which was required to reflect the surroundings, he thought that these processes were adaptable and and could be used, and in some cases were not merely probably as good as others but perhaps the only ones which could be used.

He showed as an example a zinc-base die casting. It was used to wind a bandage round and if rough it would catch in the bandage. That was why it was put through a barrel-finishing process. It was reasonably small; there was no hand work involved and nothing but the ordinary processes. He would not like to have to polish it on a mop and get such surfaces. For certain purposes barrel polishing was probably the only process which could be used, or at any rate it was very much more economical than anything else. There were other purposes for which it was unsuitable, while there were borderline cases where it or another process could be used at about the same price. There were not, however, many such borderline cases ; normally there was a sharp division.

He thought that the author, with whose views he was in agreement, had covered the subject of barrel polishing very well. So far as costs were concerned the author was probably referring to direct costs and some of the figures quoted were a little optimistic when one was not dealing with a constant supply of the same thing but had all sorts of jobs shot at one without so much as twelve hours notice and had to employ a rather higher type of labour on the barrel because the work was not simply routine.

Mr. Kellard agreed that the jobbing plater might have higher costs and had also the difficulty of having himself to develop processes, whereas the manufacturer could fall back on his suppliers to do the experimentation. Mr. Kellard also agreed that for flat products requiring high reflectivity, barrel polishing, except for certain components, was unsuitable.

Mr. B. J. Davis asked whether there was any danger in submerged barrelling, when transferring a load from one vat or tank to another, of conveying contamination from one to the other, by carry-over of the medium or particles.

Mr. Kellard replied that to deal with dragout draining for one minute was required before going to the next tank. The dragout going into the next tank could, however, be accommodated quite easily, since the cutdown compound and the burnishing compound were comparable for certain materials, but when using a descaling solution it was necessary to install an interstage water rinse tank. The amount of loss of compound in a test done on socket screws, which were difficult to deal with, was only ½ pint. The solution in the tank usually came to about 2 in. above the centre-line of the barrel, and the content of the tank was 150 gallons. The water level or compound level in the tank should not fall to more than 2 in. below the chip-mass level, so that there was 4 in. of level to play with. It was possible to get 60 batches through before the level was affected at all.

Dr. Zentler-Gordon expressed great interest in what the author had said about the new vibratory equipment and mentioned that then in Detroit last summer he had seen several of these machines exhibited and had noted the lack of information which the representatives on the stands could give to potential users. Had any progress been made in defining just what this vibrator did? It was a much more elaborate piece of equipment than an ordinary barrel. High vibration frequencies were used and probably the mass was very near resonance. Possibly reliance was placed on the resonance to achieve results. The relationship between amplitude and frequency must be very important. What measures, if any, were used to prevent such a machine going to pieces? It must be akin to a fatigue test for any piece of metal which was being vibrated at between 2,000 and 5,000 cycles per min. frequency with an amplitude of ¼-½ in. Was there any rule for achieving the various polishing, grinding and cutting effects by adjusting ratios of frequency and amplitude?.

Mr. Kellard said that the number of changes which it was possible to ring with the vibratory method was as large as with barrel finishing, and the method of getting fast cutting or a very fine finish was the same. He agreed with Dr. Zentler-Gordon's comments about the equipment. The tank in the example Mr. Kellard had illustrated was ½-in.-thick mild steel, heavily reinforced. It had been found that when the tank was made of ¼-in. material, suitably reinforced with webs, after about 3,000 hours of operation the webs suddenly all came apart. The only way of building a piece of equipment which would have a very good life was to make it at least ⅜ in. to ½ in. thick, weld it continuously and then stress-relieve it.

On the question of frequencies and amplitudes, it had been found that the most versatile range was between 1,500 and 3,000 cycles per minute. There was no advantage in frequencies as high as 10,000. The advantage, if any, of high frequency was that it took more time to produce a certain finish. Amplitude was also important. At 3,000 cycles/min. an amplitude of approximately 0.01 in. produced remarkably good results on zinc-base

die castings using a dry process, the dry medium consisting of sawdust with rouge and wax. The material was prepared by pouring warm wax over the sawdust and adding the rouge. The results had proved very interesting, but it was only a polishing process and would not remove surface defects. If there were surface defects in the component it was necessary to increase the amplitude and lower the frequency, and by increasing the amplitude to $\frac{1}{4}$ in. and dropping the frequency to 900 cycles/min. the cutting rate became fairly drastic ; but, once the surface defects had been removed, it was necessary to increase the frequency and decrease the amplitude in order to effect polishing.

DR. ZENTLER-GORDON was surprised that these vibrating equipments were liable to fall apart, because vibrators had been used in engineering for a great many years for a great many applications without this trouble. What was important was to avoid resonance ; and, having made up an assembly, it should not be difficult to find out what its resonant frequencies were and avoid them.

With regard to the variation of speed with frequency and amplitude, he would have thought that this was a most useful attribute of the system, because it meant that it was possible to start at low frequency and, without having to re-load the equipment, increase the frequency and decrease the amplitude and so go quite smoothly from cutting to polishing. He asked whether the wave-form of the vibration was sinusoidal and if the authors of the two papers presented that afternoon had any separate or joint experience of the use of chemical polishing solutions in a barrel-polishing set-up?

MR. KELLARD replied that the processing sequence used depended to some extent on the component being dealt with. In some cases a change of medium or compound might be necessary.

A machine had to be built to take the widest possible range of materials. The specific gravity of steel balls was much higher than lime-stone grit or oxide chips or the material which he had mentioned earlier as having been used successfully under experimental conditions for zinc-base die castings. The equipment must be designed, therefore, to accommodate a wide range of media.

Little research had been done on the use of chemical polishing solutions in a barrel, mainly because his company were not specialists on chemical finishing and it required a specialist approach. They had, however, done a good deal of work on the use of the submerged barrelling technique with phosphating and similar processes, with varying degrees of success.

MR. S. C. BOYLE, on the subject of chemical polishing in the barrel, suggested that it was unlikely to be possible to get abrasive and corrosive processes going on at the same time and place, because there would be mutual interference There seemed to be some advantage in using solutions in tanks and a submerged barrel. Would it be possible to have a series of storage tanks and pump solution into them?

MR. KELLARD replied that it was much cheaper to use the submerged installation, and during the barrelling process minute abrasive particles separated from the chips and the speed of the barrel tended to throw them to the outside. It would be impossible to put them back by flow into the general stream to be taken away. He had had a good deal of experience in the pumping of these solutions and it was not an easy job. The normal type of pump did not stand up to it and it was necessary to use the sludge type of pump or other types which were expensive, so that it was a question of economics. One American customer had wanted a pump arrangement with a conventional barrel and the cost had been about three times that of the normal barrel installation.

Continuing, Mr. Kellard said that barrel finishing was usually the last operation before plating, and if any thing went wrong it was always said to be due to the barrelling, though the fault usually lay with something else. He quoted the case of a customer of his who always had trouble on a Tuesday morning, when it was said that something went wrong in the barrelling shop. On investigation, it had been found that on the Tuesday the components, after being unloaded from the barrel were placed in a certain area and next door was the plating department, who disposed of their cleaning materials on Tuesdays.

MR. KELLARD answering a further question said that it was only necessary to see the agitation which took place in the tank as the barrel was revolving at 10-30 r.p.m. to appreciate that there was not very much chance that any fines were going to be pushed into the surface.

For really harsh work on castings, for example, the submerged process was not of advantage, for the simple reason that with the conventional barrel reliance was placed not only on the abrasive compound but also on the abrasive abraded from the chip-mass itself, which was kept inside and able to continue to work satisfactorily, whereas in the submerged machine this could not be done. In the conventional barrel, however, abrasive impregnation did take place and it was necessary to put on two or three subsequent operations to remove it and get the part clean and ready for burnishing. It was impossible to take a product from an abrasive process and drop it immediately into the steel balls, or the result would be a mess. It was

(*Continued in page* 17)

RESTORING CONFIDENCE IN NICKEL/CHROMIUM PLATE

New Labelling Scheme to Classify Plating Thickness

SPACE is now available to give some further details of the scheme for restoring the public's confidence in nickel/chromium plate as a finish, to which brief editorial reference was made in a recent issue.

This scheme has as its starting point the publication of a new British Standard (B.S. 1224 : 1959) entitled " Electroplated Coatings of Nickel and Chromium." Taking the new standard as the basic criterion of deposit thickness and service performance, the scheme goes on to provide for the testing of deposits for compliance with the thickness requirements of the standard, and the labelling of components plated in accordance with the standard so as to render them readily identifiable by the consuming public.

The New British Standard

The new British Standard is a revision of an earlier specification. The standard has been revised, at the request of industry, as a step towards improvement in quality of chromium plating and an answer to the all-too numerous complaints about the lack of durability of many plated surfaces. The most important change in the new edition of B.S. 1224 is a provision for thicker coatings of nickel.

With most plated products it is the layer of nickel — rather than the top " flash " of chromium — which largely decides the quality and durability of the final finish. Until recently nickel has been in short supply, but with the end of this shortage there is no longer any reason why an adequate nickel coating should not be applied.

A second important change in the British Standard is the inclusion of new, more stringent laboratory tests which plated products must be able to pass if compliance with the standard is claimed for them. Two of these tests are specially concerned to ensure that chromium plating will stand up to corrosion — a vital factor with, for example, bumpers and other automobile parts which are exposed to the weather.

In all, nine tests are prescribed in the standard. They include the tests for corrosion resistance referred to above, in which plating is exposed to the attack of sulphur dioxide, or acetic acid and salt ; tests to check the thickness of both the nickel and chromium surfaces deposited on an article ; and tests to ensure that the plated finish will not easily peel away.

Another feature of the Standard is that it specifies the minimum thickness of nickel and chromium depending on the ultimate intended use of the article, and three thickness classifications are provided for three main service environments.

Non-destructive Testing

For measuring the thickness of the layer of nickel which is called for in the standard a non-destructive instrument developed by the British Non-Ferrous Metals Research Association and manufactured by Nash and Thompson Ltd. is available, Hitherto this assessment could only be made by testing a sample to destruction — an expensive process. The standard still quotes such methods but also draws attention to the value of the new instrument for day-to-day control purposes.

Originally developed some four years ago as a laboratory instrument for determining the thickness of electroplated coatings, and described in METAL FINISHING JOURNAL, (April, 1955 issue) the B.N.F. Plating Gauge has recently been substantially modified and redesigned to make it a robust, routine inspection tool for measuring the thickness of nickel plate on steel, brass or zinc alloy die castings. For this purpose, it is rapid, accurate and completely non-destructive.

Once adjusted for the particular combination of coating and basis metal being inspected, it can be placed in the hands of quite unskilled personnel, the only operations required being to apply the spring-loaded probe with the special jig and read off from the meter the thickness of nickel. Nickel thicknesses can be measured with an accuracy of $\pm$ 0.0001-in. for the nickel ranges covered by B.S. 1224. Readings can be made in quick succession— as rapidly as one every five seconds if necessary — making thorough inspection of nickel plated parts a practical proposition at last.

The Labelling Scheme

Identification of products complying with the standard will be made possible by means of a

Restoring Confidence in Ni/Cr Plate

(*Continued from facing page*)

labelling scheme which, in the first instance, is being operated by the Mond Nickel Co. Ltd., who, working in close collaboration with the British Standards Institution, will supply various types of labels (i.e. tie-on, stick-on, etc.) at cost to platers and manufacturers of plated products who must undertake to apply these labels only to plating which complies with B.S. 1224.

The new British Standard calls for three grades of plating depending on the use to which plated products are put. The Mond labels take this into account. They are coloured RED (which indicates suitability for " SEVERE " service), BLUE (" NORMAL " service), or GREEN (" MILD " service).

For example, plating which is to be exposed for long periods in the open should have a red label ; that used indoors but where corrosion is likely (in steamy kitchens and bathrooms, for example, or on products stored in camp cupboards) should bear a blue label. Where less arduous conditions are involved the green-for-mild category will be quite sufficient. Each of the labels will announce that the nickel-chromium plate conforms to British Standard 1224 : 1959.

At this stage it will be left to platers and manufacturers to satisfy themselves that their finishes are in accordance with the standard. Large-scale buyers (such as motor-car firms) will doubtless require samples to be tested before accepting delivery of goods.

The success of the scheme will depend on the co-operation of not only the platers but also of the vast body of manufacturers who specify plating in their products. The Mond Nickel Company is convinced that, with modern facilities and improvements in the process, chromium plate can be regularly produced as a sound serviceable finish and that, if the trade will take pride in it, public confidence can be fully established.

Copies of B.S. 1224 may be obtained from the British Standards Institution, Sales Branch, 2, Park Street, London, W.1. (Price 5s. net), and the labelling scheme is fully described in the publication " Confidence in Plating " copies of which are obtainable from The Mond Nickel Company Ltd., Thames House, Millbank, London, S.W.1.

Progress in Polishing

(*Continued from page* 15)

essential to undertake three operations to prepare the part, using the conventional barrel for harsh grinding and then transferring it to the submerged operation for cleaning and to another process for burnishing. Both processes could live together and each had its own sphere.

MR. R. GOODWIN, referring to the transfer and carry-over of compound, said the author had mentioned a draining time of one minute ; but it would seem that during that time some of the solid particles in the compound would inevitably be left on the work, because the barrel stopped when it was removed. It seemed apparent therefore that the state of balance in the second tank after two or three loads must differ from its original state.

Second, the Institute had had in the past some excellent papers on barrel burnishing and barrel finishing, and Mr. Goodwin, reading these, had been convinced that the ordinary type of barrel with the spindle horizontal in the barrel was vastly inferior to the eccentric motion barrel. Were they now to assume that those excellent papers were incorrect, or had they no application to the submerged barrel?

On the question of costs, it would be useful to be given some idea of the recommended capital depreciation time for this type of equipment. Was it one, two or five years? Alongside that it would be useful to have some percentage for maintenance costs.

MR. KELLARD, on the first point, replied that the drag-over could be accommodated quite well within the process itself. On the second question, barrel shape, he said that this depended on the job being processed and the job requiring cleaning. His own company's experience, and that of one of their competitors, was that the best all-round geometry of the barrel was the straightforward octagonal with the shafts at the two ends. Claims had been made for certain types of movement, but anyone who went to the trouble of making a Perspex model, filling it with rice and then watching what happened with various types of movement, eccentric and other, could decide for himself whether or not the claims made were true. A good many customers—and his firm were customers—tended to accept anything said by the seller instead of finding out for themselves. It was desirable to investigate the claims which were made.

Cost and depreciation were matters for the company concerned. Some of the companies who dealt with his firm took a six-year period, some five years and some two. As a supplier he would put the period at four to five years. Repairs and maintenance were reduced to a minimum, and meant only an occasional belt or an occasional bearing, even with a 24-hour cycle. After two or three years it would depend entirely on what the process was. With a gentle polishing process it might be five or six years before the barrel required re-lining, but with a harsh cutting process the life of the lining was unlikely to exceed eighteen months or two years.

Measurement of SUB-SIEVE PARTICLE SIZE in Vitreous Enamels*

by J. F. BROWNE†

IN recent years enamellers have shown a growing interest in finer grinding, which has led to the need for a rapid and accurate method of determining particle sizes in the sub-sieve range.

The need for a knowledge of the sub-sieve particle-size distribution and a mean of controlling it is perhaps most important when dealing with coloured enamels and aluminium enamels, but deviations from standard quality can result from variation in sub-sieve particle size with other types of enamel.

In most millrooms the fineness, or more correctly the coarseness of an enamel is measured by washing a measured quantity of slip on a standard sieve, usually of 200 or 300 mesh, and measuring the residue which remains. This gives only one point on the particle-size distribution curve (Fig. 1) and if the enamel is ground finely this point is at one extreme end of the curve. Further, it is readily seen that two slips giving equal residues on a 200-mesh sieve can have quite different particle size distribution.

Methods Available

Many procedures have been described for the measurement of particle size ; they fall into three main groups.

(a) Microscopic
(b) Gas or liquid elutriation
(c) Gravity or centrifugal sedimentation.

The principle most readily employed for enamels is gravity sedimentation, and the two main methods depending on this principle are :

(a) Andreason pipette
(b) Hydrometer.

Of these two, the hydrometer method, although not quite so accurate as the Andreason pipette method, is less time consuming and more readily adapted for control purposes.

The Hydrometer

The hydrometer best suited for this determination is the Towers streamlined soil hydrometer, reading from 0.995 to 1.050. Since the basis of this method is to measure the specific gravity, at a known depth, it is important that the distance between the hydrometer reading and the centre of volume of the hydrometer be known. This measurement has been made in our laboratories on six separate hydrometers of the type specified above. The results are so close that for all practical purposes the figures given in Table I can be used for all hydrometers of this type. For convenience these figures may be graphed.

Table I

Scale reading	Depth of Centre below reading in cm.(L)
1.000	16.5
1.005	15.8
1.010	15.0
1.015	14.3
1.020	13.5
1.025	12.8
1.030	12.0
1.035	11.5
1.040	10.6
1.045	9.9
1.050	9.2

Theory

The maximum diameter of particles, d (in mm.) still in suspension after a given settling time, T (in min.) is given by the following expression known as Stokes Law :

$$d = g \frac{30\, L\, \eta}{(G = G_1)} T$$

where L = distance through which particles fall in T (mins.)
η = viscosity of water (c.g.s. units)
g = gravitational constant
G = specific gravity of solid material
G_1 = specific gravity of suspending medium

Calculations

For a given set of standard conditions a table can be drawn up showing the maximum diameter of particles in suspension at given times.

where L = 32.5 cm.
η = 0.0102 c.g.s. units at 19.4°C.
G = 2.65
g = 980 cm. per sec.^{2}

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* *Paper presented at Ferro Refresher Course, June 4-5, 1959.*

† Ferro Enamels Ltd.

Table II

Time T (min.)	Maximum particle diameter (d, in mm.) in suspension
1	0.078 (78 microns)
2	0.055 (55 microns)
5	0.035 (35 microns)
15	0.020 (20 microns)
30	0.014 (14 microns)
60	0.010 (10 microns)
120	0.007 (7 microns)
250	0.005 (5 microns)
1440	0.002 (2 microns)

If the conditions vary from the standard conditions then corrections must be made.

1. Depth of centre of volume (L)

$$K_L = \sqrt{\frac{L}{32.5}} \qquad (\textit{see}\ \text{Table I}).$$

2. Specific gravity (G)

$$K_G = \sqrt{\frac{2.65}{S.G. - 1}}$$

A correction for changes in viscosity with temperature is not necessary if the suspension is kept within the limits 18 to 21°C.

The value of d (Table II) is multiplied by K_L, K_G to correct to standard conditions.

The diameter of particles in suspension at given times is now known, and the next stage is to calculate the percentage of these various sizes in the sample.

This is given by the expression :—

$$P = \frac{1606\ (R - 1)\ \alpha\ 100}{W}$$

where P = percentage in suspension after a given time
R = hydrometer reading
W = dry weight of sample taken
α = specific gravity factor if S.G. is different from 2.65

$$= \frac{2.65 - 1}{2.65} \times \frac{G}{G - 1}$$

G = specific gravity of dry material

Since a 45 g. sample is used the expression for P can be simplified to :—

$$P = 3569\ (R - 1)$$

Deflocculation

It is normally necessary to deflocculate slips, and Calgon (sodium hexa-meta phosphate) is used for this purpose.

The amount of Calgon required can be determined by suspending 10 gm. of the sample (dry weight) in 100 ml. water in a cylinder, and then by adding a 33 per cent solution of Calgon observe when the sediment on the bottom of the cylinder keeps its shape while tilting the tube sideways.

In most cases 5 ml. is enough.

Since this addition alters the specific gravity of the suspending medium, a small correction is made.

If 5 ml. are added subtract 0.00025 from the hydrometer reading.

If 10 ml. are added subtract 0.0015 from the hydrometer reading.

If 20 ml. are added subtract 0.004 from the hydrometer reading.

If 30 ml. are added subtract 0.0065 from the hydrometer reading.

If 40 ml. are added subtract 0.009 from the hydrometer reading.

Calculation of Dry Material in a Slip

When the material to be tested is in slip form it is necessary to determine the weight of dry material per millilitre of slip. This is obtained from the following expression :—

$$W = \frac{(S - 1)\ G}{G - 1}$$

where W = weight of dry material per 1 ml. of slip
S = specific gravity of the slip
G = specific gravity of the dry material

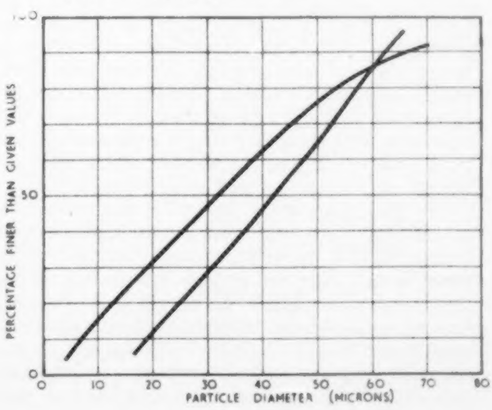
Practical Procedure

45 gm. of powder or the equivalent amount of slip is washed into a litre measuring cylinder with about 200 ml. water.

The deflocculant is added and the suspension made up to the mark, using warm water to adjust the temperature to 18 to 21°C. After stirring well a stop watch is started and the first reading is taken after one minute. It is necessary to introduce the hydrometer about 30 seconds before a reading is due, being careful to cause as little disturbance of the suspension as possible. It is

(Continued in page 27)

Fig. 1—Typical curves showing particle diameter in relation to the percentage number of particles finer than that particular diameter.



Metal Finishing Technology — A Students' Guide: 3

An Introduction to the Examination Syllabus in Metal Finishing of the City and Guilds of London Institute

Compiled by A. ALEXANDER

METHODS OF METAL WORKING

THERE are several methods of working metals and it is important that the metal finisher should be familiar with this because it often happens that the method of manufacture influences the finishing of the product and some defects which may at first appear to be due to the finishing process may often be traced back to the fabrication processes. For example a faulty casting may have a number of pin holes in it and when the part is plated these may absorb solution which will later ooze out causing defects on the finished surface. It is therefore proposed to consider the various methods of fabrication particularly with a view to discussing those defects which may produce trouble in the finishing processes.

Casting

In this process the metal is melted in a furnace and then poured into a mould. This mould may be made of metal or sand or some similar material and may be merely an ingot mould to produce a lump of metal for subsequent processing, or it may be shaped to the form of the finished article. Practically all metals, at any rate those in which the metal finisher is interested, will in the first instance be cast. Iron and steel are produced in a blast furnace and run into the moulds for subsequent rolling or forging or in some cases, into what are known as " pigs," that is lumps of cast iron for re-melting. When the article is to be produced by casting the iron or steel will normally be re-melted and poured into a suitable mould usually formed by packing a pattern of the article with sand and then removing the pattern and pouring in the metal. Brass, aluminium, and other non-ferrous metals are also dealt with in this way.

The conditions under which the casting is made are extremely important and a high degree of skill is required to turn out good sound castings. If the metal is not correctly melted and poured at the right temperature and if the mould is not properly formed, one obtains castings with a number of small holes in them called blow holes and also of irregular structure. Such castings are extremely difficult to finish satisfactorily and in fact in a good many cases a good finish cannot be produced. In some cases also the original alloy may be of the wrong composition and impurities and the like may enter the molten metal and produce trouble. Some of these troubles may be difficult to locate, but the metal finisher will usually be able to see from a careful inspection of the article, particularly after machining and polishing, where the casting is sound. Some alloys are notoriously difficult to plate but this will generally be known and allowed for and special processes used.

Castings made in sand moulds often have an outer layer of metal into which a certain amount of sand has penetrated. This may make them difficult to machine or polish. When machining it is advisable to try and get underneath this layer which is usually quite thin. If the article is not to be machined it is very essential to remove this layer by using a coarse emery bob or by shot blasting. In some cases it can be removed by pickling.

Cast iron contains an amount of free graphite and has a somewhat porous structure and this makes it particularly difficult to plate satisfactorily.

Many articles are made from die castings. These are produced in a special machine which forces the metal under pressure into a steel die. Zinc-based alloys, aluminium alloys, and in som cases bronzes and brass are cast by this method, zinc base being the most usual.

These castings often give trouble particularly because they a fairly dense outer skin and a rather porous middle. The outer layer is not very thick and if this is cut through after machining or polishing the porous middle may absorb solutions and cause blistering of the plated coating. Also if the mould is incorrectly constructed, holes or areas of unsatisfactory structure are obtained in the casting which are liable to show during subsequent finishing.

The metal finisher will no doubt experience a number of these troubles. The important thing is that he should be on the look-out for them but on the other hand it is sometimes easy to ascribe troubles to the casting when in fact the finishing

processes are themselves to blame. Where there is any doubt in the matter a very careful examination should be made, perferably by sectioning the casting and examining it microscopically. This requires to be done by someone who has some skill, not only in the preparation of the sections but in the intepretation of the results of the examination.

Rolling

Sheet metal is normally produced by rolling. In this process the metal is first cast into the ingots and then passed through a series of rolls, the first part of the process usually being carried out at a red heat depending however on the metal in question and the latter part at ordinary temperatures.

Most metals when hot will oxidize quickly in the atmosphere and thus when ingots of steel or brass are being rolled there will usually be a film of oxide on the surface. This film may tend to be broken up and rolled into the surface during the process and this will produce trouble when the article is finally cleaned and pickled ready for plating as the lines of rolled-in oxide will tend to show up and produce stains.

This often happens on aluminium which is to be anodized and this should be specially prepared if a high-quality result is required. As mentioned before, rolling and similar processes break up the crystal structure of the metal and tend to produce long crystals in the direction of rolling. The final structure will depend very much on the rolling conditions, that is to say the pressures used, temperature etc., and also whether the surface of the metal has been suitably prepared between rolling passes. Copper plates required for photo-engraving, for printing blocks, have to have a very perfect surface and this is produced by rolling under controlled conditions. Not only must the roll itself be highly polished and true but the surface of metal prior to rolling has to be carefully pickled to remove all oxide and other impurities and in some cases may require to be scurfed. The mill also must be completely free from dust and grit and precautions have to be taken to see that nothing falls on the surface of the copper as it enters the roll. For ordinary purposes of course precautions of this order are not necessary but bad samples of rolled metal very greatly add to the cost of the finishing processes.

Forging

In this process the metal is heated to just below its melting point and hammered out to a required shape. This may be done by hand or by mechanical hammers or presses. In the majority of cases forged parts are machined and are not usually polished or plated directly.

Hot Stamping

This is a rather similar process, the parts being pressed out in large hydraulic presses rather than hammered. The term stamping usually implies that the article has been stamped hot.

Drawing

In this process the metal is pulled through a die. Wire is made by drawing, the metal being first rolled out to a bar and then the end inserted through a metal die and the whole bar pulled through it reducing its diameter. As the wire gets smaller it is coiled up on to reels. Some type of lubrication is generally used and in some cases this lubrication becomes squeezed into the surface of the metal and may cause trouble if the wire has to have a bright finish.

Extrusion

In this process the metal, usually just below its melting point, is forced through a die by compressing it in a cylinder. In this way a number of specially shaped sections can be made. The process may often be used as a substitute for rolling. If the structure of the metal is examined it will usually be found to be different as the characteristic long crystalline structure of the rolled article is absent.

Pressing

A very large number of articles and small machine parts today are produced by pressing. In this process sheet metal is fed into a suitable press which may be hand operated or driven by power. Metal dies (male and female) are used which are generally highly polished and the article or part is pressed out sometimes in one and sometimes in several operations the article feeding from one press to another.

In the fabrication of the article the metal is of course bent round and it often happens that if the metal itself is of unsuitable composition or has been badly rolled or if the dies are not properly designed, small cracks and surface defects occur. Also in many cases if the dies are not well finished, deep grooves are formed in the surface of the article which may be very difficult to remove if this is required with a highly polished surface.

One of the most common defects in pressing is known as an ' orange peel ' surface and occurs particularly on the radius of curved portions. Such surface defects will require to be removed if a high finish is necessary and may cause considerable trouble in the polishing process.

Machining

This process consists of cutting the metal to the required shape by means of a lathe, shaper, mill, planing machine or other tool. The process does not usually produce any great trouble for the metal

finisher although in certain cases, special lubricants may be used which may be difficult to remove from the surface of the article prior to finishing.

METHODS OF JOINING

For many purposes it is necessary to join metal together, either pieces of the same metal or in some cases dissimilar metals. A number of processes can be used for this, the chief of which are welding either by gas or arc, resistance welding brazing, hard soldering and soft soldering. Metals may also be joined together mechanically by riveting, folding and rolling, or by screwing them together. For many applications joining can be effected by synthetic resins.

Welding

In this case the metal is joined by melting two edges and usually running in a small amount of additional metal to make the joint. Welding of course is applied only to joining two similar metals. The two most usual methods are arc welding and gas welding.

Arc Welding

In this process the two pieces of metal are brought together and joined to one side of an electrical circuit of moderately low voltage, say about 40-90 volts.

The other side of the circuit is made to a small metal electrode of the same metal as the one to be joined. An arc is then struck between the electrode and the metal surface and this melts the two edges to be joined and also deposits metal from the electrode on to the hot surface. In this way a joint is made which is practically equivalent to the solid metal. Some skill is required to carry out the process and if it is not correctly done the weld may crack or there may be pin-holes in it. In the majority of cases a certain amount of structure change will take place in the metal around the weld due to the heating and there is also a likelihood of a certain amount of oxide being formed. Welds of this nature are very difficult to finish and will practically always show up even after polishing. In some cases an inert gas is blown round the arc to prevent oxidation.

Gas Welding

In this case the heating is done by means of the oxyacetylene blow pipe, additional metal being fed into the weld by means of a welding rod, the end of which is melted and allowed to flow over the surface.

Resistance Welding

In this case the two pieces of metal are brought together and a high low-voltage current applied to the join. In this case the voltage is probably only a fraction of a volt but the heavy current flowing through the join in the metal produces considerable heat which brings it to a red heat. At the same time pressure is applied and this causes the two metals to fuse together and form a weld. The weld may be in the form of a round spot produced by two electrodes or in the form of a long seam produced by rollers.

Bars may also be welded together by this method by putting the two ends in a suitable machine, passing a heavy current between them and pressing them together. Resistance welds of this type have usually an area in which there is a considerable amount of oxide and this is very difficult to remove by the ordinary acid treatment.

Other Methods of Welding

There are several other methods by which metals can be welded together. For example, blacksmiths heat the metal to just below its melting point and hammer the ends together on an anvil. It is unlikely, however, that the metal finisher will be required to deal with other types of welding.

Brazing

In this case the metal is joined by heating the two parts in question and melting brass over them so that it flows through the joint. A flux, usually borax, is required to make the brass run. When the article is cooled off this flux, together with some brass is usually left on the surface of the metal around the joint and is often difficult to remove. The process of course is applied normally only to steel, but it can be used for metals which have a melting point higher than brass. Borax is usually difficult to remove and requires pickling in dilute acid for some time, and it is necessary to remove it before painting or plating.

Hard Soldering

This is a process similar to brazing except that a hard solder is used in place of brass. These solders composed of various alloys are usually of lower melting point than brazing materials so that it is not necessary to heat the metal to so high a temperature. Many are composed of silver alloys and for soldering gold, gold alloys are used.

A flux is again required and the same precautions will have to be taken to remove it before the article is finished.

Soft Soldering

In this process a low-melting-point alloy usually of tin and lead is melted and run over the surfaces to be joined. The flux most generally used in this case is zinc chloride although rosin and other similar compounds are often used for electrical purposes. These fluxes are somewhat easier to remove and will normally come off in the ordinary

preparation processes but soft-soldered joints may sometimes be difficult to cope with because a certain amount of solder will flow over the surface round the join. It is often difficult to get a satisfactory finish on this and it may be found advantageous to copper the article prior to other plating processes.

Riveted Joints

A riveted joint is formed by drilling a hole through the two pieces of metal to be joined, pushing through a rivet and hammering over the head — this may be done cold or hot. Riveted joints are most troublesome to the plater as solution, etc., can seep in between the two metal surfaces and will later ooze out causing trouble. Whenever possible, articles with riveted joints should be painted. It is seldom possible to get a really satisfactory plated finish on them.

Other Mechanical Methods of Joining

Generally speaking, these will be carried out after metal finishing and will therefore not form any particular problem to the metal finisher.

ELECTRICAL PLANT

Electroplating requires a low-voltage direct current which has to be specially generated or transformed and rectified. Other finishing processes also require the use of electrical furnaces, ovens and motors so that in the average finishing shop there will be a considerable amount of electrical plant. It is very necessary that the man in charge of this shop shall understand the main features of this plant for in some cases he may have to be responsible for its maintenance and working while in any case, even when qualified electrical staff are available, it will be necessary for him to discuss the various problems arising with them. At the same time the average plater does not have the opportunity of qualifying as an electrical engineer and it is not necessary for him to do so. All that is necessary is that he should understand the main features of the plant with which he is likely to come into contact. In the following therefore only this plant will be discussed.

It is assumed that the reader of this article will already be aware of the fundamentals of the electrical current, that is to say he will know the units used to measure it and the difference between a direct and alternating current, and be familiar with the 3-phase current normally supplied by the Electricity Boards. It is also assumed that he will have some knowledge of low-voltage direct current and the way this is applied to a vat. These points have already been dealt with in the article on the operatives course and we will therefore consider here the various special plants used in the metal-finishing shops and the problems that may be encountered.

Generators

Low-voltage d.c. may be produced by a generator. This will normally be driven by an electric motor although in some cases it may be driven directly from an internal combustion or steam engine. For producing a low voltage the generator will require to have a heavy winding of thick copper wire or rod and a very large commutator otherwise there will be large voltage losses in the armature of the machine which will be inefficient and will tend to heat. Up to about the beginning of the last war the majority of plating shops were fed in this way, the motor generator being a very common piece of plant but at the present time rectifiers are gradually supplanting them, at least with voltages up to 16. It is comparatively rare these days to find motor-generator sets.

The motor-generator set normally consists of a motor suitable to run off the mains mounted on the same bed as a low-voltage generator and directly coupled to it. A small excitor dynamo is often coupled to the same shaft to produce the current required to excite the generator field.

When a conductor is moved across a magnetic field a current is generated in it and this is the principle on which the machine works. The field magnets situated around the armature are generally excited by a separate dynamo especially in the large machines although they can be excited by the current generated by the machine itself. In this latter case, however, it is more difficult to maintain the machine at a steady voltage. A regulator is incorporated in the field circuit so that the amount of current flowing through this can be controlled and this will control the output of the machine. To produce a direct current it is necessary to arrange a commutator at the end of the armature otherwise the current in the conductors will flow first in one direction and then in the other. This commutator is composed of sections of copper insulated from one another and the current is picked up from it by means of brushes made of a mixture of copper powder and graphite compressed together. This commutator must be kept clean and it is necessary that the insulation between the segments should be below the surface of the segments themselves otherwise they will cause sparking. The care of these commutators is important and unless they are properly maintained the machine will not function satisfactorily. The brushes must be carefully adjusted both for the amount of tension on them and their position so that sparking is at a minimum ; the copper surface must be kept clean and free from dust and usually requires a slight film of grease lubrication. If the machines are well looked after and not overloaded they will normally give little trouble. From time to time one may find a black skin forming on the commutators and the output of the machine falling

off. This can be corrected by cleaning the commutator carefully with sand paper. Brushes will also require to be adjusted from time to time and replaced when they have worn down as otherwise the copper wire incorporated in the end will come into contact with the commutator and scratch it. The machine should be very carefully levelled so that the armature floats, it being desirable that it should move slightly from end to end while working so that the commutator does not become scored by the action of the brushes.

The average electrician does not have much experience with machines of this nature and when they are employed it is advisable to check these points and make certain that they are being satisfactorily maintained. If the commutator is badly scored it should be carefully turned down and refinished but it should be remembered that with each turning of the commutator the maximum output of the machine will be lowered and in fact the commutator may ultimately become so much reduced in size that it has to be rebuilt otherwise the section of copper in it will be too small to carry the required current without overloading.

Motor generators should be installed on heavy concrete beds to make sure that the bed on which they are mounted does not warp and bring the machine out of line. They are preferably installed in a separate compartment and should be away from the plating shop atmosphere. They should be kept clean and the copper dust produced by the commutator brushes should be blown out from time to time with an air blast. Bearings should be checked occasionally to see that they are not overheating and be kept well lubricated.

As previously mentioned the rectifier has now almost entirely replaced the motor-generator set at any rate for the lower voltages. Motor generators, however, are still used to some extent for chromic acid anodizing and also may be used in certain special operations where a reversal of current is required as the heavy currents used can be easily reversed by reversing the comparatively low current in the generator field and this obviates heavy switchgear.

Rectifiers

The original rectifiers used for plating were of the copper-oxide type but at the present time selenium rectifiers are generally used. Germanium rectifiers are being tried out and may have some advantages for certain purposes, while silicon rectifiers may also be used in the future to some extent but it seems probable that the selenium rectifier will be the most favoured for the majority of purposes for some time to come.

The plating rectifier is somewhat similar to that often found in radio sets and battery chargers.

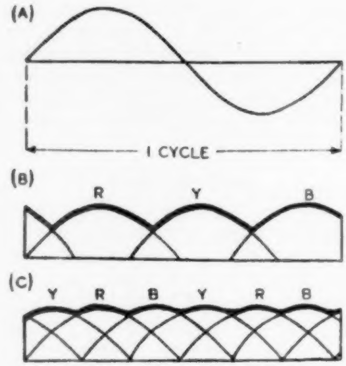


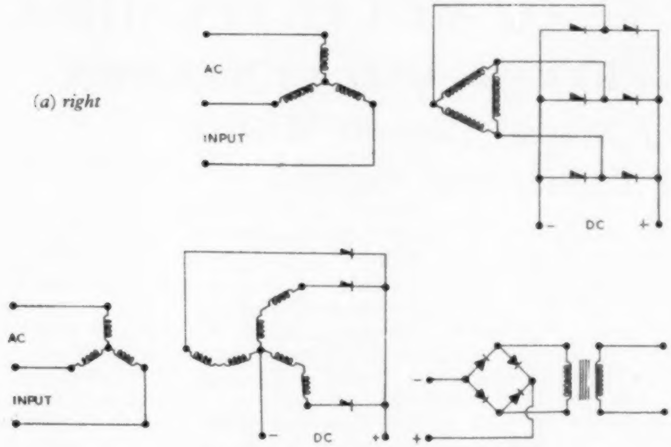
Fig. 1.—Oscillogram of a.c. current showing (a) one phase, (b) rectified current from two-phase supply, and (c) rectified current from three-phase supply.

It is designed to carry a high current and consists of plates of copper or aluminium coated with a layer of selenium and backed up with a low-melting point metal. This system has the property that it will allow current to flow through it in one direction only and in fact may be looked upon as a diode valve. Mains current is supplied usually as 400 volts 3 phase alternating current. This must be transformed to the low voltage required by means of an ordinary static transformer. It is then passed through the rectifier unit which allows the current to flow in one direction thus producing a direct current. The circuits are so arranged that a current from each of the 3 phases is superimposed so that a unidirectional current is obtained which has a ripple in it due to the way it has been produced. This may be shown diagrammatically (Fig. 1).

When dealing with radio sets it is necessary to smooth this ripple by means of condensers otherwise a hum will be produced but for plating this is not necessary. It is somewhat problematical whether the rippled current is preferable to a smooth direct current but it has certainly never been shown to have a disadvantage and in fact it is probable that the plating vat itself acts to some extent as a condenser. In some cases special wave forms and periodical reversal of the current have been used but these are not normally made use of in plating shops although certain advantages have been claimed.

The plating rectifier is usually built up as a complete unit the smaller ones up to about 1,000 amp. being supplied with a transformer and rectifier unit in one tank filled with transformer oil and supplied with cooling fins. In larger units the transformer and rectifier are often in separate tanks and separate controllers may also be fitted which can be positioned near the plating vat.

(a) right



(b) (c)

Fig. 2—(a) Circuit of 3-phase full-wave rectifier

(b) Circuit of 3-phase half-wave rectifier

(c) Circuit of single-phase full-wave rectifier

A certain amount of control may be obtained by tapping the primary winding on the transformer but it will be realized that if the voltage of the rectifier is required to be greatly reduced this would mean having a very large winding on the primary which would be uneconomical and have other disadvantages. In such cases therefore an auto-transformer is placed in the primary circuit and the control made on this.

A selenium rectifier is completely sealed, the elements being immersed in transformer oil and all that is necessary is occasionally to check the oil level. Provided the rectifier is kept painted it can be positioned in the plating shop or even in an outside yard and will give good service for a number of years.

The actual life of a selenium rectifier is somewhat doubtful as they have not been in continual use long enough to get any satisfactory figures. Providing that they are not overloaded they should last for at least 10 years and probably twice this time, in fact there are many which have been in service from the early part of the last war. If they are overloaded however, the plates may break down and have to be replaced although this can be done comparatively easily by the manufacturer. It is usually an advantage therefore to run the rectifier at somewhat below its stated output although it can be run at quite considerable overload for short periods. If it is overloaded for too long the plates will overheat and become permanently damaged.

The windings and circuits of rectifiers vary with their size and manufacture. The majority of the larger rectifiers are made to work from 3-phase current supply and are full wave (Fig. 2a) or half wave rectifiers having a circuit similar to Fig. 2b.

Some of the smaller rectifiers are designed to work on a 230-volt single-phase current and some of these are full-wave rectifiers with a circuit similar to Fig. 2(c).

Single phase rectifiers are not advised for chromium plating because the current falls to zero between the cycles.

The efficiency of a plating rectifier is fairly high being usually of the order of about 80-85 per cent. Its power factor is generally of the order of 0.8, but this power factor is due to slight wave distortion and cannot be corrected by inserting condensers.

Rectifiers should be placed in a well ventilated position and if they have to work in a hot atmosphere their output must be somewhat reduced otherwise they will over-heat. In the case of a large rectifier, (for example, 12-volt, 3000-amp.), this will have a d.c. power loss of some 9-12 kilowatts and will therefore produce a fair amount of heat which if the rectifier is fitted in a small room may cause trouble.

The rectifier will normally be supplied with a volt meter and ammeter so that its terminal voltage may be checked and the total current produced will be shown. In some cases a special overload arrangement may be fitted to reduce or break the current if the stated output of the rectifier is exceeded. Selenium rectifiers usually work on an 8-volt unit and if a higher voltage than this is required it is necessary to double the number of plates. This means that the cost of the rectifier will be very much increased when more than 8 volts is required. A 16-volt rectifier, however, has usually a somewhat better power factor than the 8-volt rectifier.

THE INSTITUTE OF METAL FINISHING

AUTUMN MEETING AND LUNCHEON

Report of Annual General Meeting and Presidential Address

THE Eighth Annual General Meeting of the Institute of Metal Finishing was held at the Charing Cross Hotel, London, on November 30. Dr. T. P. Hoar, president of the Institute was in the Chair. After the formal adoption of the Minutes of the previous Annual Meeting the statement of accounts was presented by the Hon. Treasurer, Dr. J. E. Garside. The accounts revealed the happy position that the deficit which had characterised the accounts in recent years had been changed in the past year to a very satisfactory surplus. This had arisen in part from an increase in subscription income and from an increased surplus from the Annual Conference in Brighton, but the principal factor had been the revised publishing programme.

The Annual Report of the Council for the previous session was presented by Dr. T. P. Hoar in the absence abroad of the Hon. Secretary, Dr. S. Wernick. The Report made reference to the new format of the Transactions and to the difficulties which had attended their production, and of the last Volume of the old-style proceedings, arising from the dispute in the printing industry and from the sudden and regretted death of the assistant editor, Mr. H. A. B. Catley.

The small increase in membership, which had been recorded at the previous session, had been still further increased, and the session had been marked by a new venture by the London Branch in the form of a one-day Symposium on the theme of " Control in Electroplating ", which attracted an attendance of over 200 members and visitors.

The Annual Conference at Brighton was notable for the record number of papers, 24 in all, which were presented. The 400 delegates who attended were representative of nine other countries in addition to the U.K. The Fifth Hothersall Memorial Lecture had been delivered by Professor R. S. Hutton, a past-president of the Institute, who had taken for his theme " A Lifetime's Retrospect."

The Institute as a constituent member of the International Council for Electrodeposition and Metal Finishing, had been responsible for arrangement in connexion with European participation in the Fifth International Conference on Electrodeposition and Metal Finishing held in Detroit, U.S.A. during June. Over thirty members of the Institute attended this meeting, and there were nine British contributions to the Technical Sessions. At a meeting of the International Council held in Detroit, it was agreed that the next International Conference should be held under the aegis of the Institute, probably in 1964.

The full report, which had been previously made available to members present, was adopted.

The Annual General Meeting was followed by a Luncheon attended by some 80 members of the Institute and their guests, at which the principal guest and speaker was Mr. G. L. Bailey, Director

Mr. A. A. B. Harvey, following his induction as President of the Institute of Metal Finishing is congratulated by his predecessor in office, Dr. T. P. Hoar.

of the British Non-Ferrous Metals Research Association.

Following the Luncheon, Dr. T. P. Hoar, the outgoing president, formally inducted the new president Mr. A. A. B. Harvey into office and invested him with the Presidential Badge.

PRESIDENTAL ADDRESS

'The Role of the Scientific Society'

Following his formal induction, Mr. Harvey delivered his Presidential Address on " The Role of the Scientific Society."

Mr. Harvey began his address by examining the historical development of such societies as the Institute of Metal Finishing, with a view to discussing how the demands peculiar to the present time might be met. In many cases two bodies had grown up in parallel serving the same technical area : one whose interests were solely in publishing and spreading of knowledge, while the other had as its object the creation of a corps of professional men to serve the newly developing industries. In other cases, for example, the Institutions of Civil and Mechanical Engineers, these functions were combined in a single body and this has commonly been the practice adopted by most of the Institutes which have since come into being to serve the interests of the different branches of engineering science.

As the nineteenth century progressed the weight of production of material for publication increased with a marked tendency for publication in German journals, as German was at that time the langugage of science. Mr. Harvey put forward the interesting proposition that the relegation of technology to a status of social inferiority to pure science and of both to classical studies was initiated by the untimely death of Prince Consul so that for many years thereafter the volume of material published describing the results of research into technological problems remained small. Over the last fifty years however, the need for such technological Institutions as the Institute of Metal Finishing had been increasingly appreciated so that at the present time there can be very few specialized technologists which are not catered for in this way.

Mr. Harvey then went on to explore and deplore the reasons for the long delays to which the publication of original work is now subject. The first of the delaying factors to which he referred was the question of national security. The balance between the scientists fundamental duty to spread new knowledge as widely as possible and the equally fundamental right of a Government to withhold publication of what it believed to be harmful to national security, was in time of peace delicately poised. However, just as in the sixteenth century knowledge burst the bonds imposed on it for what was then sincerely believed to be the spiritual wellbeing of man, so in the twentieth century it must be jealous of those ties imposed for his political welfare.

The second and most cogent reason for delaying publication was its cost. It was becoming increasingly difficult for scientific societies and Institutes to sustain their major role as publishing bodies out of their subscription incomes and the question of how this work was to continue was becoming acute.

Mr. Harvey felt that it was best answered by asking who received the most benefit from such publishing activities. The answer he said was that the greatly enlarged scope of the Institute's publishing activities had benefited an increasingly widespread of those engaged in all branches of metal finishing and allied subjects.

This had only been possible because of the devotion and single mindedness of purpose of the Honorary Editor, who had shouldered the responsibility for the last thirty years until the burden had become one which no honorary officer should be called upon to bear unaided.

The time had come, concluded Mr. Harvey, when the volume and reputation of the Institute's work demanded an increased staff and a home consonant with its standing and with the importance and size of the industry that it was its role to serve. This was a great and flourishing industry and it was to that industry that the Institute looked for support.

Measurement of Sub-Sieve Particle Size

(*Continued from page* 19)

normally only necessary to take readings at 1, 2, 5, 15, 30 and 60 minutes.

The results are best presented graphically by plotting the particle diameter against percentage finer than that particular diameter.

Conclusion

At a first reading it may be thought that this method is too involved for control laboratory use, but in most cases a comparative result is more important than an exact one.

If for example, two millings of a groundcoat are being compared, and the specific gravity of the frit is the same in both cases, therefore, no correction is necessary. The specific gravity of the slip is normally adjusted and the mill additions are the same. The test procedure then may become as simple as weighing out say 70 gm. of slip, washing into the cylinder, adding say 5 ml. of Calgon solution, and taking the hydrometer readings.

Under these conditions valuable information can be obtained by control personnel in a comparatively short time at very low cost.

FINISHING

NEWS REVIEW

A.S.T.M. WEEK IN CHICAGO

Panel on Colour and Gloss of Anodized Aluminium

Approximately 1500 to 2000 people will meet at the American Society for Testing Materials' committee week meeting in Chicago at the Hotel Sherman, being held from February 1-5.

About thirty of the Society's main technical committees will hold some 350 meetings of subcommittees and working groups to advance toward completion the year's committee work in anticipation of preparing reports for presentation to the Society at the annual meeting at Atlantic City next June.

Among a total of 32 committee meetings are the following : A-5 on corrosion of iron and steel; B-2 on non-ferrous metals and alloys; B-3 on corrosion of non-ferrous metals and alloys; B-8 on electrodeposited metallic coatings; C-22 on vitreous enamel; E-7 on nondestructive testing; E-12 on "appearance"; and E-15 on analysis and testing of industrial chemicals.

Panel discussion on measurement of colour and gloss of anodized aluminium alloys

The E-12 committee on appearance is sponsoring a panel discussion on measurement of colour and gloss of anodized high-silicon architectural aluminium alloys on February 4. R. V. Paulson, Kaiser Aluminum and Chemical Corp., will serve as moderator. The other three panel members are: R. T. Myer, Kaiser Aluminum and Chemical Corp., who will discuss appearance measurement from the management viewpoint; Eric Barkman, research department, Reynolds Metals Co., who will discuss gloss measurements; and W. C. Cochran, research department, Aluminum Co. of America, who will discuss colour measurement of transparent and semi-transparent films on aluminum.

The subjects to be considered at this panel discussion were described in an article on "Measurement of Appearance of Aluminium Surfaces" in the December ASTM *Bulletin*. All those interested in this subject are cordially invited by the Society to attend.

The Chicago district council of the Society, under the chairmanship of S. H. Wallace, (Badall Engineering and Mfg. Co., Hammond, Indiana), is planning the committee week dinner and the social hour preceding it. Other officers of the council are: vice-chairman K. R. Parker, (Joslyn Mfg. and Supply Co., Chicago) ; and secretary C. S. Macnair (Acme Steel Co., Chicago).

PAINT AGREEMENT GIVES ACCESS TO MORE TECHNICAL INFORMATION

A PAINT "know-how" agreement has been signed between Group Developments Ltd. and Glidden International, subsidiary of the Glidden Co. of Cleveland, U.S.A., one of the leading American paint manufacturers.

The agreement gives Group Developments Ltd. and its subsidiaries the exclusive right to use the U.S. company's development and manufacturing technology and their formulations in the United Kingdom.

Group Developments have one paint subsidiary in the U.K., Cellon Limited, who will enjoy access to all the information available to the parent. The Glidden Co. have a turnover in paints of some £90 million per annum, and are renowned in both the industrial and decorative fields. They have divisions operating throughout North America and licencees all over the world.

As a direct and immediate result of this agreement it is expected that Cellon will acquire access to up-to-date information on technical developments, manufacturing methods and marketing techniques in the vast paint industry of the U.S.A.

Synthetic-Resins Factory Starts Production in the Netherlands

A SYNTHETIC-resins factory at Katwijk-aan-Zee, Holland, has started the production of a new long oil-length alkyd resin based on isophthalic acid and differing from the usual linseed and soya-oil types in chemical composition and technical characteristics.

With the development of alkyd resins for decorative enamels produced on an orthophthalic base by the usual method, a limit has been reached which cannot easily be exceeded. There is still the possibility of accentuating certain properties, but such improvement affects the other properties of the product ; the improvement of drying properties and water resistance, for example, generally has an adverse effect on workability and body, and conversely.

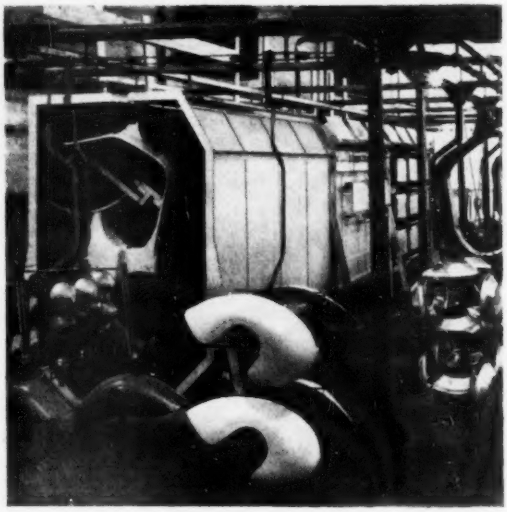
The formulation of alkyd resins on an isophthalic base instead of the usual phthalic types opens up new possibilities. The recently developed product is said to combine the easy brushability and workability of the classical oil paints with the rapid drying of the modern synthetic materials.

It is said to possess all the favourable properties that make oils such attractive materials for house paints: good flow, easy application, high gloss and excellent gloss retention. At the same time, it is said to have the advantages of a synthetic vehicle; rapid drying, good through hardening and excellent weather durability.

It is claimed that the new resin can be used both in house paints and in offset printing inks where low viscosity and thorough drying are of importance.

A few characteristics of the new resin are : oil content 75 per cent; isophthalic acid content 20 per cent; acid value 4-10 per cent.

GAS ASSISTS THE SCOOTER "REVOLUTION"



Gas-fired paint stoving oven used for parts of the Vespa scooter.

The congestion in urban traffic and the prohibitive prices of petrol have been formative influences in the design of transport for personal use in most of the larger towns of Europe.

In Britain since the war, the remarkable gain in the popularity of the motor scooter and the enclosed motor cycle has led to large numbers of these vehicles appearing on our roads, and some of the older established firms in the motor cycle industry have now gone over completely to their manufacture.

One such firm, the Douglas Co. of Bristol, already famous in the motor-cycle field, decided at a very early date that the scooter would in time prove a valuable asset as a means of cheap, independent travel in this country, and as a result the Vespa was introduced to England by Douglas in 1951.

Since that date Douglas, through their Vespa organization, have sold approximately one hundred thousand of these world-famous scooters, including a considerable number to public bodies.

The machines are produced at Bristol under licence from Piaggio of Italy, in a modern factory using all the latest assembly line methods common to the motor car industry.

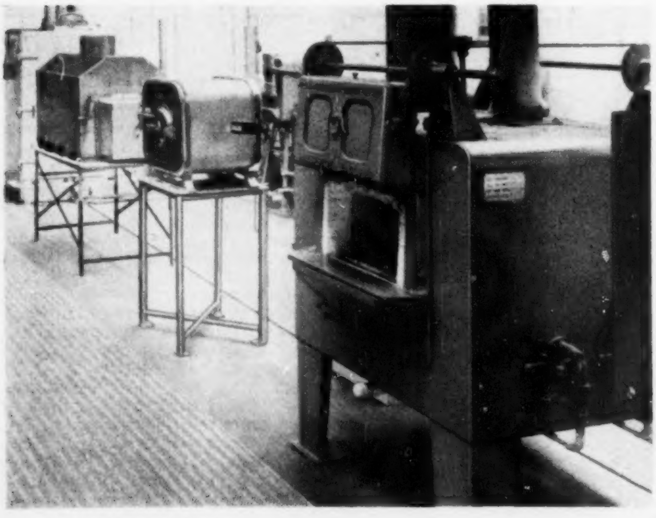
Automatic temperature control

Construction of the components for the power, transmission and braking systems present many problems for the metallurgist. Most of these depend upon heat treatment—carburizing, tempering, and so on—which demand very close time temperature schedules.

For this reason most of the furnaces are on automatic temperature control where thermocouples measure the temperature and transmit an electrical signal to control pyrometers which operate valves in the gas supply according to the measured temperature.

This ensures that the temperature never varies from the close limits necessary for correct heat treatment which largely determines the life of these parts.

(*Continued in page* 31)



SOUTH WEST GAS INDUSTRIAL SHOWROOMS

As part of its service to industrialists in the area, the South Western Gas Board has recently opened an industrial gas showroom at Barton Street, Bristol 2, where factory executives can inspect working examples of infra-red tunnels, natural-draught oven furnaces, recirculating ovens, and other equipment.

Anyone can bring along components in which they are interested and try them out with the equipment in advance of purchase.

In addition, there is a wide range of gas burners together with ancillary equipment such as flame protection and ignition systems where automatic temperature control figures prominently. A view of the showroom is shown left.

FINISHING LUNCHEON CLUB MEETING

THE Christmas meeting of the Finishing Luncheon Club was held on December 17 when over seventy members were present to hear the principal guest, Mr. Jack Train. Following the meeting a cheque for £25, representing the surplus for the year, was sent as a Christmas donation to Dr. Barnardo's Homes.

The next meeting will be held on February 11 at the Rembrandt Hotel when Mr. G. E. Sandland will speak and answer questions on the new Mond labelling scheme for specifying nickel/chromium plate.

Anyone interested in attending the next or future luncheon meetings is invited to communicate with the Hon. Secretary, Finishing Luncheon Club, 17/19, John Adam Street, W.C.2.

I.C.I. Plans Extensions To Solvents Production

A MAJOR extension to the trichloroethylene and perchloroethylene plants is to be built at I.C.I.'s Castner-Kellner Works, Runcorn, at a cost of £1 million.

Technical service and development work on the uses of these two solvents has been carried out by I.C.I. over many years, and this has led to a growing demand for both products, particularly in the engineering industry for metal-degreasing and also for dry-cleaning.

The extension now planned will increase the company's combined capacity for these two solvents by 25 per cent, and will enable I.C.I. to satisfy the demands of the home market for several years, ahead and permit a further increase in its present considerable export trade.

The extension will be based on a new manufacturing process which is expected to lead to lower production costs. It will be completed in 1961. Initial reductions of 30s. per ton in the price of trichloroethylene and £5 per ton in the price of perchloroethylene were introduced on January 1.

NEW COMPANIES

"Ltd" is understood also "Private Co." Figures = Capital, Names = Directors, all unless otherwise indicated.

Yong (Dispensometers), 48 Market Place, Reading. November 12. £100. To take over bus. of manufacturers of and dealers in and to grant licences for the manufactures of "Dispensometers" etc. James W. Edwards, Aldric B. Au-Yong, Cecil J. Hayward.

Liquid Metal Applicators, 129, Mottingham Road, Mottingham, S.E.9. November 12. £100. Dennis G. Cox, Mrs. Hilda M. Ritson.

Baja, 117, Berkeley Avenue, Chesham. November 16. £100. To carry on bus. of electro platers, etc. Wm. G. Adams, Joyce A. Adams.

Bicc-Burndy. November 17. £250,000. To enter into an agreement dated September 30, 1959 between Burndy Corporation and British Insulated Callender's Cables Ltd.; to carry on bus. of manufacturers of and dealers in electrical accessories, etc. Directors not named.

L.R. Services, 128/134, Baker Street, W.1. November 19. £5,000. To carry on bus. of metal workers, cutters, processors, etc. George F. Rapp, Henry G. Collins.

M. Cohen Supply Company (Birkenhead), 17. Brandon Street, Birkenhead. November 19. £100. To carry on bus. of manufacturers of and dealers in paints, enamels, varnishes, etc. Michael Cohen, Betty M. Owen.

Owen (Birkenhead), 12, Brandon Street, Birkenhead. November 19. £100. To carry on bus. of manufacturers of and dealers in paints, enamels, varnishes, polishes, etc. Betty M. Owen, Michael Cohen.

Ceraco (Lancs.), 120 St. Anns Road, Prestwich, Manchester. November 23. £900. To carry on bus. of manufacturers and merchants of chemicals of all kinds for the use in the manufacture of or making rubber, paper, paint, textiles, food, metal, plastic and other commodities and products, etc. Leon Stoger, John Waldie.

Davies Electroplating, 1, Prospect Mews, Prospect Street, Reading, Berks. November 25. £1,000. To carry on bus. of electroplaters, metalworkers, etc. John Finnerty, William Davies.

Field Abrasives, 62, Nield Road, Forest Gate, E.7. November 27. £1,000. Joseph H. Bowen, Catherine V. Bowen.

Craft Chemical Products, Westminster Bank Chambers, 2, Queens Road, Watford, Herts. November 30. £100. Constance Hall, Arthur F. Hall, Ernest A. Ivemy.

Par-Tool (Filters), 2a, Essex Street, Luton, Beds. November 30. £1,000. To carry on the bus. of manufacturers and merchants of filtration equipment for the engineering and chemical industries, etc. Directors not named.

Verulam Chemical Descaling, 10, Mayflower Road, Park Street, St. Albans, Herts. December 1. £1,000. Arthur E. Egan, Mrs. Rosina A. Egan.

Rye Solvents. December 2. £10,000. To carry on bus. of solvent distillers, manufacturers of and dealers in and refiners of waste spirits, chemicals, etc. Clifford H. Worringham, Philip J. Bate, Alexander J. Cole. Solicitors: Kingsley Wood & Co., E.C.4.

V. C. Conyers, Shaw Road, Blowers Green, Dudley, Worcs. December 3. £2,000. To carry on bus. of manufacturers of and dealers in metal, metal hollow-ware, aluminium, etc. Reginald A. Swaby, Victor C. Conyers, Leslie G. Swaby.

From the Register compiled by Jordan & Sons Ltd. 16 Chancery Lane, London, W.C.2.

Gas Assists the Scooter Revolution—

(*Continued from page 30*)

Town gas used

The Douglas Co. uses town gas supplied by the South Western Gas Board for melting, hardening, tempering, and carburizing, as well as stoving the synthetic-paint finishes. For these purposes town gas is thought to be the most suitable fuel because its declared calorific value is a significant factor in precise automatic control.

Other advantages are that there are no interruptions for fuel deliveries, and the gas meter provides the simplest and cheapest form of fluid fuel costing.

In the foundry, gas is used for core drying, and aluminium-alloy melting is carried out in three gas-fired melting furnaces, the molten metal being used for the gravity die-casting of the light-alloy components.

Crank-shafts, gears, and similar parts require special heat treatment, and in the carburizing shop there are three gas-fired muffle furnaces as well as a high-speed tempering furnace. Other non-ferrous components are treated in gas-fired salt bath furnaces.

Finishing Shop

The chassis, mudguards and other parts, after assembly, stress-relieving, and filling, pass on conveyors into the finishing shop. After being sprayed with a number of priming and finishing coats of paint, the components pass—still on conveyors—into a gas-fired infra-red paint stoving oven which was specially designed to suit the awkward shape of the chassis.

Again, town gas was chosen as the fuel because of the close time/temperature schedules required to stove the modern synthetic paints.

TECHNICAL *and* INDUSTRIAL APPOINTMENTS

The **O. Hommel Co.,** Pittsburgh manufacturer of ceramic raw materials, has announced the appointment of Mr. Loran F. Smith as manager of the west coast district, with offices in Los Angeles.

Mr. Smith has been associated with Hommel as a sales-service engineer on the west coast since 1955 and in the new position will continue his former duties.

He has a wide background in the ceramic industry, having held responsible positions in almost every phase of clay products manufacturing. Prior to joining Hommel he was plant manager of Stuart B. McCulloch Co. and before that was affiliated with Pacific Clay Products Co., Fairchild and Suman, Inc., and Santa Anita Potteries.

* * *

Dr. John E. Cox, senior research fellow at Mellon Institute for the **O. Hommel Co.,** Pittsburgh 30, Penna, U.S.A., has been named director of research and development of the company's vitreous enamel frit division.

Dr. Cox will be responsible for the vitreous enamel frit division laboratories at the Carnegie, Pennsylvania plant and also for the fundamental work for which he has always been responsible at Mellon Institute.

Dr. Cox became associated with O. Hommel in 1954 from the research laboratories of the New Jersey Zinc Company. In his new position, he assumes the duties formerly performed by Mr. Hollis S. Saunders.

* * *

Mr. J. W. Armstrong has joined **Styrene Co.-Polymers Ltd.** to develop the sales of their new range of " Scopacron " thermosetting acrylic resins. He was previously with the Shell Chemical Co., where during the past few years he has been closely associated with the development of Epikote resins and the introduction of the Shell range of solvents for the surface coating and allied industries.

Mr. Armstrong, who is a science graduate of Glasgow University, has also had 10 years' experience with I.C.I. at their Billingham and Dyestuffs Divisions.

* * *

Dr. W. J. Bushell has been co-opted to the board of **Cellon Ltd.** and has been appointed deputy chairman. He is director and general manager of the chemical division of Courtaulds, the parent company.

Mr. Loran F. Smith

Mr. J. W. Armstrong (right)

Dr. John E. Cox

Mr. A. Wallace Barr has been appointed Managing director of Cellon, succeeding Mr. W. J. Shilcock who has retired after 46 years with the company. It is of interest to note that Mr. Barr is the son of the founder, Mr. A. J. A. Wallace Barr, who started the firm in 1911.

Mr. F. J. Smith has been appointed secretary of the company, and he also can claim long service—38 years.

* * *

The Incandescent Group (which includes The Incandescent Heat Co. Ltd., Metalectric Furnaces Ltd., Controlled Heat and Air Ltd., and Selas Gas and Engineering Ltd.) has opened an area office at 40, Newport Road, Cardiff (Telephone: Cardiff 37715) under the management of Mr. J. W. Payne, who has been operating for the group in South Wales for the past two years.

* * *

As leading designers and builders of industrial furnaces, **The Incandescent Heat Co. Ltd.,** Smethwick, have supplied capital goods to India for almost half a century. Throughout this period the company has been represented by A.B.T.M. (India) Ltd., the manager of which, Mr. J. S. Halbert, is well known throughout Indian industry. The Incandescent Heat Co., are now seconding Mr. B. A. Harper to the staff of A.B.T.M. (India) Ltd. His post will be that of senior furnace technician (India). His wide experience has been gained in the foundry plant division, development division, and the export division, where he was engaged on technical sales to the Indian market.

* * *

Mr. T. M. Horn has retired from the position of manager of the Leeds branch of **Atlas Copco (Great Britain) Ltd.,** Maylands Avenue, Hemel Hempstead, Herts. Mr. A. W. Tombleson, from the firm's Manchester branch has been appointed to succeed him.

Concurrent with this change, the existing Leeds area has been divided and a new branch office is being established in Newcastle. The branch manager in Newcastle will be Mr. W. Hossent.

* * *

Mr. Anthony Cockle has been appointed " reliability " engineer of **Solarton Electronic Instruments.**

Previously he had been engaged in guided weapon reliability engineering from 1956-59, at Vickers-Armstrong (Aircraft) Ltd. and E.M.I. Electronics Ltd. He has been a member of the British aircraft construction electronic component committee and was a founder member of the Ministry of Supply guided weapon reliability panel.

His age is 34 years. Born in Kingston-on-Thames in 1925, he was educated at Tiffins (Kingston-on-Thames) School, The Northampton Engineering College, London, E.C.1, and Kingston Technical College.

TECHNICAL BOOKSHELF

Recorder Survey: Recording Surfaces and Marking Methods. George Keinath. Washington: 1959. National Bureau of Standards Circular 601, U.S. Government Printing Office, Washington 25, D.C. 41 pp. 30 cents. (Order from Superintendent of Documents).

This publication surveys and compares the characteristics of continuous traces, dotted traces, and printed characters produced by inking, incision, impression, indentation, deposition, heat, light, electric discharge, electron beam, magnetism, chemical action, or fluid streamlines. Descriptive and reference materials are included on three physical components of the recording system — the reservoir of material or energy, the marking point or matrix positioned by the measuring element, and the chart surface which preserves the record.

This survey was undertaken to collate available information on the various methods and problems of recording scientific and technical data. The survey covers some of the physical principles either currently or potentially available for recording variable measurands in laboratory experimentation or industrial production.

Many recording principles have found practical application in commercially available recorders, and both illustrations and performance information have therefore been drawn largely from manufacturers' literature. Information obtained from commercial sources has been carefully reviewed, but no test programme was carried out to verify performance claims.

This first volume deals with marking methods and recording surfaces. Work under way in the reviewing of recorder actuating mechanisms, special recording problems, and data presentation may result in the issuance of a later report on these aspects.

Zinc Dust Paints. London: 1959. Translation and Technical Information Services, 32 Manaton Road, London, S.E.15. 5s.

This is a bibliography of selected literature on the subject prepared as a number of duplicated sheets in a loose leaf folder.

References have been collected from two main sources: the publisher's own indexes (recent literature and particularly the Continental patents) and from the Review of Current Literature published by the Paint Research Station, Teddington (older literature and British patents).

In the introduction to the work, the editor points out that all the individual items have been checked where possible, but in some cases, "such as the elusive Chemische Rundschau (Solothurn), the data have been taken secondhand." Where this has occurred, both original and abstract references are given.

A hundred references are listed, and the introduction groups these under various heads, such as binders (air and stove drying separately), zinc dusts, zinc oxides, antisettling agents, solvents, two coat systems, etc. Altogether, a most useful compilation for those with an interest in the subject.

Compilation of ASTM Standards on Soaps and Other Detergents (D-12). Philadelphia: 1959. American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa., U.S.A. 256 pp. $3.50.

The volume contains 40 standards, 11 of which are new, revised, or have had their status recently changed, and should prove useful to metal cleaners, and others concerned with the manufacture or use of cleaning materials.

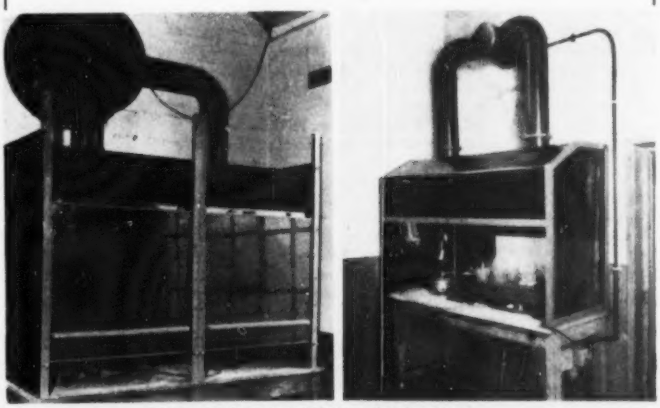
Typical of the material covered in the volume are specifications for soaps (bar, chipped, powdered); alkaline detergents, methods of tests for detergents and soaps, as well as definitions. There are seven specifications for soaps, nine specifications for alkaline detergents and twenty test methods besides the definitions.

MIDDLE EAST TOUR FOR DETEL DIRECTOR

MR. L. A. Johnson, director and sales manager of Detel Products Ltd., has recently returned from a 4-week business tour of the Middle East. He stopped off in Rome en route for a consultation with associates interested in coatings for industrial and atomic projects.

Mr. Johnson visited refineries, government departments and service establishments in Aden, Khartoum, Bahrain, Beirut and Kuwait. He returned to London earlier this month.

No Fire Risk Here



FUME CABINETS IN "COBEX"

NON-INFAMMABLE "Cobex" manufactured by BX Plastics Ltd., reinforced with expanded metal has been used to make two fume cupboards recently installed by Tanks and Linings Ltd. for the Ever Ready Co. Ltd., and the Washington Chemical Co. Ltd. Both cupboards are completely made from Cobex, including the angle framing and ducting which house the extractor fans, so making the whole installation corrosive resistant.

P.V.C.-steel in building

STELVETITE USED FOR LEWIS'S

SOME 70,000 sq. ft. of Stelvetite, the plastic-coated steel sheet—the biggest single application of this material so far—has been used for partitioning the new London central buying offices of Lewis's Ltd., the well-known provincial department store chain.

The new offices occupy the complete third and fourth floors of a new building at 40 Duke Street, London, W.1. The third floor has a gross area of 25,373 sq. ft. with a reception hall seating 100 and 88 offices for central buyers, plus accommodation for their clerks and secretaries.

The fourth floor covers an area of 22,656 sq. ft. It includes a suite of 21 offices for the board of directors, a board room and 36 other offices used mainly for the administrative sections.

All the corridor and internal office partitioning for both these floors is of Snead-type flush movable walling supplied and fitted by Luxfer Ltd., Harlesden, N.W.10.

With the exception of the reception hall, directors' suite and board room, both sides of all the walling—35,000 ft. super on each side—is in Stelvetite.

All the partitioning has a flush finish, although erected in sections and movable if a change of office layout is desired. The double Stelvetite panels have half-inch insulation board cemented to the inner side of each panel, allowing dead air-space of 1¾-in. wide between the two panels. The completed walling has a sound reduction of 37 decibels, a tested figure, giving the sound proof qualities of a three-inch wall.

A complete partition consists of panel units, pilaster cover wall and ceiling channel and link plate—the units are automatically bonded by the link plates. Wireways are provided down all posts and horizontal rails for electrical and telephone wiring.

The posts at the end of each unit are clamped rigidly by link plates ; joints are subsequently covered by a snap-on plate which can easily be removed. The link plates, too, can be easily removed, leaving the panels free for re-erection in another part of the office.

The floor and ceiling fixings are simple and leave no mark, should the panelling be removed.

Occupation of the new offices started last month. The head office of Lewis's Ltd. remains at 40 Ranelagh Street, Liverpool.

LEVINSTEIN LECTURE By L. H. WILLIAMS

MR. L. H. Williams, will give the fifth Ivan Levinstein Memorial lecture under the title "The future of chemicals from petroleum." on Friday, February 5, 1960, in Manchester. Further details will be announced later by the Society of Chemical Industry, 14, Belgrave Square, London, S.W.1, who say that all interested persons will be welcome.

FILTER ELEMENTS MAKERS EXPAND

A LARGER factory for their engineering section has been acquired by Aerox Ltd. at Chalford, Stroud, Glos., to manufacture equipment incorporating porous ceramic filter elements. The elements will continue to be made at the Hillington (Glasgow) plant.

The increased floor space of the new factory (five times greater than that of the old premises at Crawley), has allowed the installation of improved facilities and new equipment.

Industrial Detergent Company Formed

THE formation of Reddish Detergents Ltd., Stanley Road, Cheadle Hulme, Cheshire, to take over certain commitments previously handled by the Reddish Chemical Company Ltd., was announced recently.

Reddish Detergents will have a range of detergents for the metal, food and dairy industries. In addition, it will specialise in the manufacture of products for firms who wish to market their own formulations.

INCREASED PRODUCTION OF TANTIRON

ONE of the Kestner group of companies, Lennox Foundry Co. Ltd., has recently installed an additional melting furnace for the production of "Tantiron," a corrosion-resistant high silicon iron for acid plant. The furnace has a capacity of 200 tons per annum.

Lennox have been making this particular type of iron since 1910, but recent agreements made by the parent company allow for its manufacture in the Union of South Africa by the Kestner company in Johannesburg.

PAINT, VARNISH AND LACQUER PRODUCTS DISCUSSED IN U.S.A.

A.S.T.M. Hold Third Pacific Area National Meeting

THE activities of the American Society for Testing Materials committee D-1 on paint, varnish, lacquer and related products were reviewed during the society's 3rd Pacific area national meeting in San Francisco, October 12-16.

In the United States, the interior use of latex paints, even on masonry, has proved so successful that sales are now counted in tens of millions of gallons each year. On exterior wood surfaces, however, failures are said to have developed within the first year or two of weathering.

Roy C. Simon (The Dow Chemical Co.), described studies made to find the causes of failure in outdoor applications. Exposures over new wood and over oil-base house paint primers showed that the start of latex paint film failure and the extent of failure related to the type of wood, the type of graining in the wood, and to the type of latex system.

The testing programme evaluated these factors to help in the development of a successful latex system for wood. It was stated that latex paints have now been designed to meet the needs revealed by the testing programme.

In a paper on "Lightfastness Testing of Pigment Colors," W. F. Spengeman and G. Wormald, E. I. du Pont de Nemours & Co., Inc., reported lightfastness correlation data on a variety of pigment colours of markedly different chemical constitution dispersed in a single vehicle system at a constant pigment volume concentration of 15 per cent.

The vehicle was a good quality air drying, medium length, soya bean oil modified alkyd. The finishes were sprayed to complete hiding on primed aluminium panels and exposed in both Florida and Delaware in an Atlas "Fade-Ometer" (type FDA-R) and an accelerated weathering unit (X-1-A).

Results from Florida and Delaware were in qualitative agreement, although colour changes in Florida proceeded at a faster rate. These tests show that the relative colourfastness of pigments of the same chemical nature can be reliably compared in both wet and dry accelerated exposure devices (Fade-Ometer and AWU).

The approximate colourfastness on exterior exposure of a pigment, or the relative colourfastness of two or more pigments which differ in chemical nature, can not usually be reliably predicted from accelerated exposures except when correlation has been previously developed and corresponding "speed-up-factors" applied.

Unless modified, however, the accelerated devices cannot duplicate the influence of abnormal atmospheric conditions, for example chemical impurities.

GAS AT WORK IN INDUSTRY

AN exhibition illustrating "Gas at Work in Industry" will be held at the Royal Horticultural Hall, Westminster, from March 1 to 12.

It is the second of its kind, the first having been staged in 1957, and is sponsored by four of the area gas boards—Eastern, North Thames, South Eastern and Southern.

How gas continues to meet the demands of modern industry will be demonstrated by working plants, models, photographs, films, etc. There will be demonstrations of metal melting, tinning, diecasting and special purpose plant for the clean heat treatment of metals.

Another feature will be the vitreous enamelling of aluminium, of special interest as it will employ plant of new design. Drying operations by means of direct and indirect plant will be seen, and an infra red plant will carry out paint finishing operations.

AWARDS AT ATLAS COPCO DINNER

PRESENT-GIVING was the appropriate theme of the annual dinner given by Atlas Copco (Great Britain) Ltd. of Maylands Avenue, Hemel Hempstead, Herts, for their sales staff last month. The dinner followed the company's annual sales conference.

Mr. Erik Johnson (left), managing director of Atlas Copco (Great Britain) Ltd. from 1949-1952 and now a deputy managing director of the parent company in Stockholm, who was about to celebrate his fiftieth birthday, received a silver cakestand in honour of the event.

The retirement of Mr. T. M. Horn, manager for many years of the company's Leeds branch, was marked by the presentation to him of a wallet with appropriate enclosures. Mr. F. Bentley, manager of the Manchester branch, and Mr. E. W. Devenish, manager of the portable air compressor division, both received gold watches to celebrate their completion of twenty-five years' service with the company. The presentations were made by Viscount Bridgeman, K.B.E., C.B., D.S.O., M.C., chairman of Atlas Copco (Great Britain) Ltd., who is seen on the right of the picture above.

MEETINGS OF THE MONTH

January 18

Institute of Metal Finishing (London Group). "New electrochemical porosity test," by S. C. Britton, and M. Clarke, at the Northampton Polytechnic, St. John Street, London, E.C.1. 6.15 p.m.

January 20

Institute of Vitreous Enamellers (Southern Section). "Some aspects of pre-enamelling control and technique," by A. K. Williams, at the Howard Hotel, Norfolk Street, W.C.2. 7.15 p.m.

January 21

Institute of Vitreous Enamellers (Midland Section). "Consumer promotion by the V.E.D.C.," by K. Jones, at the Birmingham Exchange and Engineering Centre, Stephenson Place, Birmingham. 7.30 p.m.

January 21 and 22

Society of Chemical Industry (Corrosion Group). Conversazione and exhibition, at the Battersea College of Technology, Battersea Park Road, London, S.W.11. 6.30 p.m. and 9.30-3.30 the following day.

January 25

Institution of Plant Engineers (West and East Yorkshire Branch). "The development of the oil flooded rotary air compressor," by P. C. Bevis (Broom and Wade Ltd.), in the Houldsworth School of Applied Science, Leeds University. 7.30 p.m.

January 26

Sheffield Metallurgical Association. "The analytical chemistry of the platinum metals," by E. Jackson (Sheffield College of Technology), at the BISRA Laboratories, Hoyle Street, Sheffield 3. 7 p.m.

February 3

Society of Chemical Industry (Oil and Fats Group meeting with Physical Methods Group of the Society for Analytical Chemistry). "Spectroscopic investigations of fats," by D. Chapman, at the Chemical Society's rooms, Burlington House, London, W.1. 7 p.m.

February 5

Society of Instrument Technology (Fawley Section). "Why control processes automatically?" by Prof. R. H. Macmillan, at the Administration Building, Esso Refinery Fawley. 5.30 p.m.

February 9

Society of Instrument Technology (Manchester Section). Symposium "Moisture movement," at the Manchester Room, Central Library, St. Peter's Square, Manchester 1, 6.45 p.m.

February 9

Institution of Plant Engineers (Manchester Branch). "Problems in chemical engineering maintenance," by J. C. Veale, at the Engineers Club, Albert Square. 7.15 p.m.

February 10

Institute of Metal Finishing (Organic Finishing Group). "Choice of application methods for organic finishes," by E. Podmore and D. W. Hislop, at the British Institute of Management. 80, Fetter Lane, London, E.C.4.

February 11

Society of Chemical Industry (Corrosion joint meeting with the Liverpool Metallurgical Society and College Scientific Society). "Recent research on the corrosion and protection of iron and steel, by J. C. Hudson, at the College of Technology, Byrom Street, Liverpool. 6.30 p.m.

February 11

Institution of Plant Engineers (North East Branch). "Selection of electric motors for industrial purposes," by H. C. Ruffle (English Electric Co. Ltd.), at Roadway House, Oxford Street, Newcastle-upon-Tyne. 7 p.m.

February 11

Liverpool Metallurgical Society (Joint meeting with the Society of Chemical Industry). "Recent researches in the corrosion of iron and steel," by J. C. Hudson (B.I.S.R.A.), at the College of Technology, Liverpool. 7.30 p.m.

February 15

Institute of Metal Finishing (London Branch). "Complexones in Metal Finishing," by Dr. T. K. Aiken, at the Northampton Polytechnic, St. John Street, London, E.C.1. 6.15 p.m.

February 17

Society of Chemical Industry (Corrosion Group). "Adsorption on electrodes and its relation to rates of electrode processes," by R. Parsons, at 14 Belgrave Square, London, S.W.1.

February 18

Institute of Vitreous Enamellers (Midland Section). "Jewellery Enamelling," by Mr. Ore, at the Station Hotel, Dudley. 7.30 p.m.

February 23

Institution of Chemical Engineers. "Vibratory ball-mills," by H. E. Rose, at the Geological Society, Burlington House, London, W.1. 5.30 p.m.

HOLMAN EMPLOYEE'S SUGGESTIONS AWARD

EMPLOYEES of Holman Brothers Ltd., Camborne, are encouraged by what is called a "Suggestogram" scheme to put forward suggestions for improving efficiency, increasing productivity and cutting production costs. Not only does it promote the active interest of employees in the group's manufacturing activities but there are also generous rewards for any good idea adopted. To quote from the Group's handbook, "The awards usually equal the estimated direct wages saved in one year. A substantial saving in material is also rewarded."

In a recent review by the Suggestogram committee of the current ideas received, the top award went to 28 year old Mr. William Small, an inspector in the Carn Brea Works. His idea has resulted in a new method of lining vats used in an electro-plating process which is said to cut installation and renewal costs appreciably. He is shown in the photograph above being presented with a cheque for £580 by the company chairman, Mr. P. M. Holman (right).

Latest Developments in PLANT, PROCESSES AND EQUIPMENT

High Intensity Bench Light

DESIGNED around the new miniature 12 in. fluorescent tubes is the recently-marketed, local-lighting unit, known as the " Allen " Type A.90, illustrated in Fig. 1.

The use of miniature fluorescent tubes is claimed to have many advantages for local lighting, amongst which are bright ' white ' light without heat, shadow or glare, and long tube life with extremely low current consumption.

The metal reflector, housing two 12 in. 8 W miniature fluorescent tubes, is connected to the main body by a 12 in. " stayput " flexible tube and a swivel joint. This design makes the reflector fully adjustable for height, and it will swivel and tilt without heavy friction or the need of locking devices.

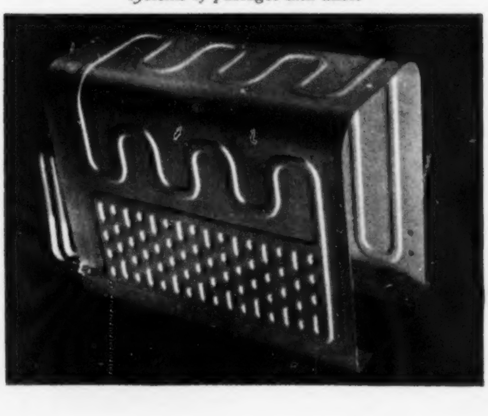
The control gear is contained in the body and two alternative bases are available for either fixed or universal use. The unit is made in steel and is well finished in silvery grey hammer stove enamel with bright chrome tubing. For a.c. mains 200/250V, the total consumption is only 20W, with a light output equivalent to 70W, of tungsten lighting.

Fig. 1—A bench light designed to accommodate a 12 in. fluorescent tube

Sheet with Integral Ducts

ILLUSTRATED in Fig. 2, " Noralduct " is solid aluminium sheet having internal systems of passages and ducts. It is particularly suitable for heat transfer equipment and, as the integral passages can follow almost any complex continuous pattern that can be drawn on paper, there are many other possibilities.

Fig. 2. (below).—Solid aluminium sheet having internal systems of passages and ducts



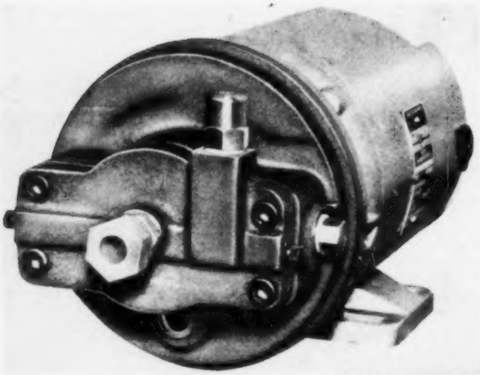
Sheets of Noralduct can be formed after manufacture, as are those used in refrigerator evaporator components, for example. Either a plain or an impressed pattern finish is available and colour can be included in the product designs as there are no welds to spoil the appearance of an anodized finish. Makers are Northern Aluminium Co. Ltd.

Small Capacity H.P. Hydraulic Pump

A NEW addition to their range of Mono-Radial hydraulic pumps is announced by Andrew Fraser and Co. Ltd., 29, Buckingham Gate, London, S.W.1 (Fig. 3).

Known as the HOA series, the pump has been designed and produced for applications where high pressure is needed but only small capacity required. The unit is ideally suitable for powering hydraulic jacks or for providing a power source for pressure testing small hydraulic components.

The pump, close-coupled to a 1 h.p., 1,450 r.p.m. Brook A.C. motor, can be supplied as a separate unit or as part of a complete packaged assembly. This includes a 5-gal. capacity oil reservoir, pressure



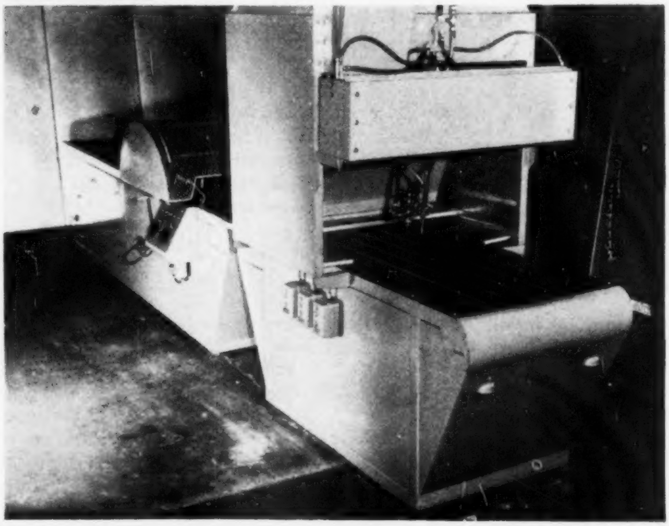


Fig. 3 (above)—A high-pressure, small capacity hydraulic pump

Fig. 4 (right)—A horizontal conveyor used for applying a flocked surface coating

Fig. 5 (below)—A range of expanded metal dipping baskets

regulating and stop valves, pressure gauge and pushbutton starter. The range includes pumps of the following outputs: 60 cu. in. per min., maximum pressure 6,000 lb. per sq. in. ; 80 cu. in. per min., maximum pressure 5,000 lb. per sq. in.

Adhesive applicator for " Flockostat."

A NEW unit, designed for use with the " Flockostat," which speeds up the flow on flat surfaces or slightly curved objects has recently been introduced by Aerostyle Ltd., Sunbeam Road, North Acton.

A horizontal ladder type conveyor approximately 6 ft. long x 2 ft. 6 in. wide is chain driven by a geared motor unit operating on 400V. 3-phase, 50 cycles, with a surface speed of approximately 10 ft. per min. (Fig. 4).

Horizontal traversing mechanism carries a Model AGP spray gun, automatically timed to apply the correct amount of specified adhesive to the adjusted horizontal distance required, thereby coating the object to be flocked evenly and to the correct depth for the short fibres when they bombard the adhesive under the electrostatic flocking feed.

After preliminary adjustment, control is simple. In a recent installation, the adhesive is fed to the traversing spray gun unit from a 3-gallon pressure feed container. Fume extraction is through filters by a separately powered enclosed exhaust fan unit in the top of the machine.

A new guard has been devised for the flocking head on the Flockostat itself, easily removable but ensuring that operators cannot place their hands near the energised components of the electrostatic flocking machine. Although not lethal any stray charges can be uncomfortable, the makers say.

Expanded Metal Dipping Baskets

A RANGE of robust dipping backets offered by Tool Treatments (Chemicals) Ltd., Colliery Road, Birmingham Road, West Bromwich, is made from expanded metal. It is claimed that use of this material has made the baskets cheaper in price than the usual type of wire mesh basket. The baskets are suitable for use by the plating trade and metal finishing industries since it is claimed they will withstand extensive pickling in hydrochloric acid solutions.

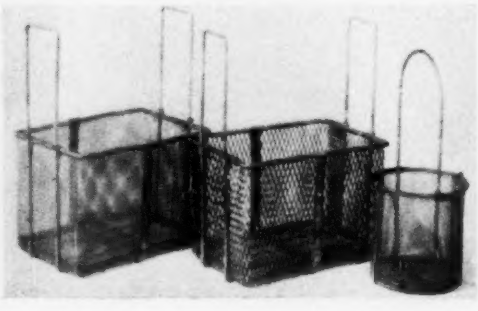


Fig. 6—Sander and Grinder

Improved sander and grinder

ILLUSTRATED in Fig. 6 is a new grinder, type LSS 62 introduced by Atlas Copco (Great Britain) Ltd. It is an improved version of the earlier model LSS 61, which it supersedes.

The improvements include an entirely new patented tubular throttle that is claimed to avoid air restrictions and eliminate leakage. A hardwood handle, shaped for comfort, absorbs vibration and maintains a comfortable temperature for the hand.

A hardened front end to the driving spindle prevents possible damage to the hexagon socket caused by the clamping key nut. The machine is available with four different speeds, ranging from 4500 to 8000 r.p.m.

Protection of Silver from Tarnish

THE "Argalin" treatment for protecting silver against tarnish has been approved by the Ministry of Supply under DTD. 900, and given the reference "DTD.900/4636," according to a recent announcement from Roto-Finish Ltd., 39, Park Street, London, W.1.

Argalin is a simple electrolytic treatment consisting of immersion from between 1 and 2 minutes in a solution followed by rinsing and drying.

The standard test to determine the efficiency of the Argalin coating is immersion for half an hour in 2 per cent. potassium sulphide solution, without any appreciable change in appearance. Silver plated articles immersed in this solution usually show evidence of considerable tarnish in less than a minute.

The system is said to be suitable for silver plated cutlery, decorative silver ware and for electrical contacts. It is also used to ensure that the silver plated surface remains bright during storage and transport. For instance, in the case of electrical contacts, it can protect these against tarnish before assembly, and can also protect contacts in switch gear assemblies, so that these are still untarnished when the equipment is delivered to the user.

The Argalin coating is extremely thin, is colourless, and does not alter the appearance of even high finish silver, it is claimed. The makers say it does not affect the solderability or contact resistance.

Flexible Shaft Machine

THE "Morrisflex 300," is a flexible shaft machine developed specifically to meet the requirements of the skilled craftsmen of the toolroom and those engaged on similar high precision work, by B. O. Morris Ltd., Coventry.

A finger-tip control allows speeds of 3,000, 9,000 or 15,000 r.p.m. to be selected. Drives to three separate shafts are incorporated, enabling the operator to carry out successive operations without the necessity of dismounting and mounting tools. Rotary files and cutters, mounted points, drum sanders, brushes, etc., can all be used with the machine.

The prime mover is a $\frac{1}{8}$-h.p. motor complete with three-speed box. The flexible drive of all three speeds, high, middle and low are complete with a hand piece fitted with a 6-mm. collet, and the company supplies all the various tools and equipment necessary.

Paint Remover for Metals

BEFORE "Metalife" liquid metals can be applied to iron and steel, all old paint must be removed so that it will come into direct contact with the iron and steel it subsequently has to protect. Though the most effective way of removing the old paint is often by using a paint remover, conventional paint removers have sometimes proved to be unsatisfactory for this purpose.

A paint remover known as "Metastrip" deep-penetration paint remover has therefore been produced by Southern Metalife Ltd., Station Square, Harrogate, Yorks, that is claimed to meet this need. Based primarily on a solvent for removing oil-bound paints, it also contains solvents to assist in the removal of cellulose paints, french polish, stoving enamels etc.

The evaporation of the solvents is retarded so that their effectiveness is increased. The remover is non-inflammable and will not run on a vertical surface. The addition of wetting and emulsifying agents ensures that the surface can be washed down with water after use. The remover is free from acids and alkalis, the makers say.

Classified Advertisements

Prepaid rates: FIFTEEN WORDS for 7s 6d. (minimum charge) and 4d per word thereafter, or 24s. per inch. Box number 2s. 6d., including postage of replies.

FOR SALE

ONE BRIGHT NICKEL PLATING PLANT complete, Cannings Super Gleamax, 30" x 18" x 18", suitable for jewellery, with complete Gold and Rhodium plant. Box 221. METAL FINISHING JOURNAL.

DEGREASING. I.C.I. LV.2 Gas Heated Plant for sale, in First Class working order. 8 years old, present cost £171 accept £50 or nearest offer. Otter Controls Limited, Otters 'Ole, Market Street, Buxton, Derbyshire.

CHARGING FORKS. One double and one single fork of Incandescent manufacture, suitable for 10 ft. furnaces. Very good condition. Reasonable price. Apply Box. No. 218 METAL FINISHING JOURNAL.

FOR SALE

SHOTBLAST PLANT. Tilghman Multi Rotary Table TS4, complete with all electric motors, electric control and dust extractor. Excellent condition. Low price for quick sale. Apply Box No. 219 METAL FINISHING JOURNAL.

PLANT AND MACHINERY WANTED

DEGREASING, TRICHLORETHYLENE PLANT required. LV.2 Model. Good working condition. 'Phone where view for cash offer—ASTon Cross 2663.

PATENT

The Proprietors of **British Patent No. 697904** are prepared to sell the patent or to licence British manufacturers to work thereunder. It relates to a method for fixing Glass Denses on Vitreous Enamelled Boards. Address: Boult Wade & Tennant, 112, Hatton Garden, London, E.C.1.


For economy...
Goodall Brand

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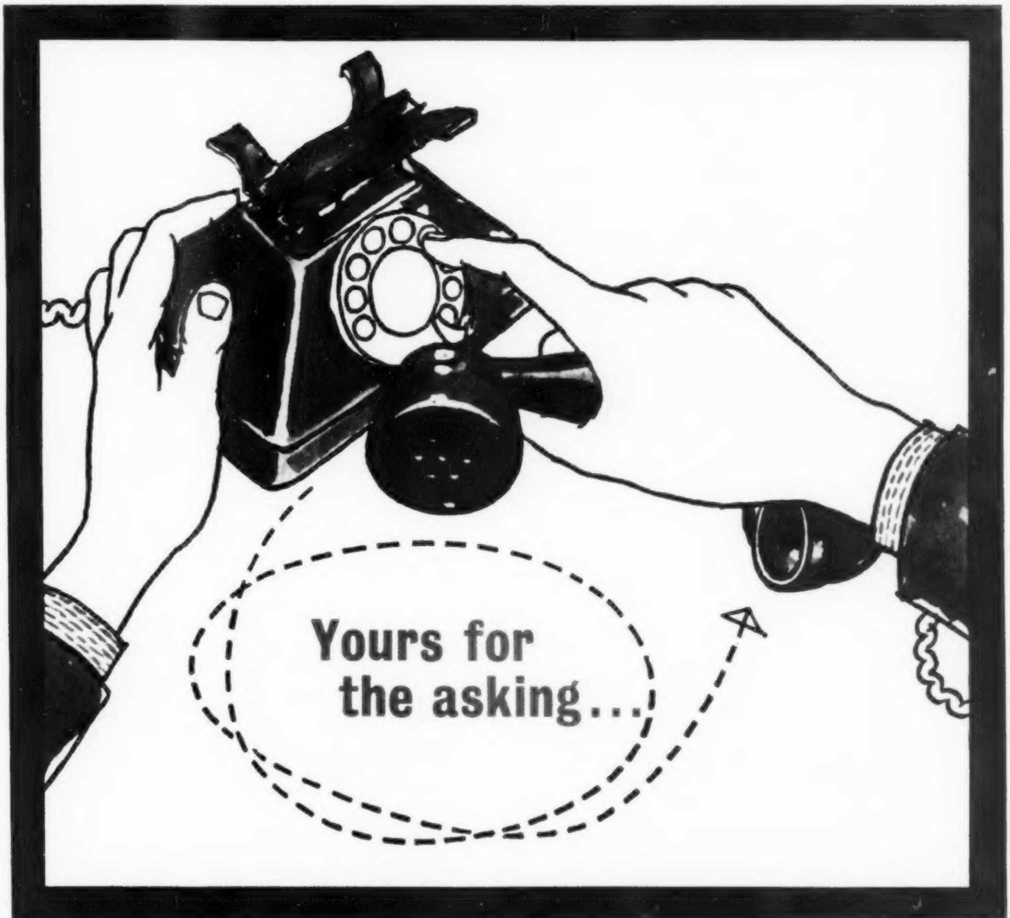

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